

## Workshop Manual

Arteon 2018 ➤ , Atlas 2017 ➤ ,  
CC 2012 ➤ , Caddy 2016 ➤ ,  
Crafter 2017 ➤ , Golf 2013 ➤ ,  
Golf 2015 ➤ , Golf 2017 ➤ ,  
Golf Cabriolet 2012 ➤ ,  
Golf MEX 2018 ➤ ,  
Golf Sportsvan 2015 ➤ ,  
Golf Sportsvan 2018 ➤ ,  
Golf Variant 2014 ➤ ,  
Golf Variant 2015 ➤ ,  
Golf Variant 2017 ➤ ,  
Golf Variant MEX 2018 ➤ , Jetta 2015 ➤ ,  
Jetta 2018 ➤ , Passat 2015 ➤ ,  
Passat (NMS - US) 2016 ➤ ,  
Passat Variant 2015 ➤ , Polo 2014 ➤ ,  
Polo 2018 ➤ , Scirocco 2015 ➤ ,  
Sharan 2016 ➤ , T-Cross 2019 ➤ ,  
T-Roc 2018 ➤ , TGE 2017 ➤ ,  
The Beetle 2017 ➤ ,  
The Beetle Cabriolet 2017 ➤ ,  
Tiguan 2016 ➤ , Tiguan MEX 2017 ➤ ,  
Touareg 2015 ➤ , Touareg 2018 ➤ ,  
Touran 2016 ➤ , Transporter 2016 ➤ ,  
e-Golf 2014 ➤ , e-Golf 2017 ➤ ,  
e-up! 2017 ➤ , up! 2012 ➤ , up! 2017 ➤

**Air conditioning systems with refrigerant R1234yf -  
General information**

Edition 02.2019



## List of Workshop Manual Repair Groups

### Repair Group

00 - Technical data

87 - Air conditioning system



Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.



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## 00 – Technical data

### 1 Safety information

(VRL012721; Edition 02.2019)

⇒ [“1.1 Safety precautions when working on air conditioning systems”, page 1](#)

⇒ [“1.2 Safety precautions when handling refrigerants”, page 1](#)

⇒ [“1.3 Safety measures when working on vehicles with a start/stop system”, page 2](#)

⇒ [“1.4 Safety measures when using air conditioner service stations”, page 2](#)

⇒ [“1.5 Safety measures for working on vehicles with high-voltage system”, page 3](#)

⇒ [“1.6 Safety precautions when working in the vicinity of high-voltage components”, page 4](#)

⇒ [“1.7 Safety measures when working on pressurised tanks/containers”, page 4](#)

#### 1.1 Safety precautions when working on air conditioning systems

##### Risk of fatal injury and explosion from sources of ignition

Risk of fatal injury and explosion from sources of ignition in the vicinity of air conditioning systems and refrigerant tanks. Escaping refrigerant could ignite and cause an explosion. Risk of explosion leading to loss of life or serious injuries.

- Never bring sources of ignition close to air conditioning systems and refrigerant tanks.
- Avoid electrostatic discharge, sparks from tools striking surfaces and hot surfaces.

##### Risk of damage to refrigerant lines

There is a risk of damage to the refrigerant lines due to rupture of the inner foil.

- Never bend refrigerant lines to a radius less than 100 mm.

#### 1.2 Safety precautions when handling refrigerants

##### Risk of suffocation and poisoning from refrigerant

Coughing and nausea leading to suffocation and poisoning from refrigerant vapours possible.

- Never inhale refrigerant vapours.
- Only work on the refrigerant circuit and refrigerant tanks in well ventilated areas.
- Never work in or near cellars or other low lying areas.
- Switch on the extraction system.



### Risk of freezing injury from refrigerant

When working on the air conditioning system, there is a risk of highly pressurised refrigerant escaping from the system. There is a risk of injury to the skin and parts of the body due to freezing.

- Wear protective gloves.
- Wear protective goggles.
- Extract refrigerant and open the refrigerant circuit immediately afterwards.
- If more than 10 minutes have passed since the refrigerant was extracted, repeat the extraction process before opening the refrigerant circuit. Pressure could build up in the refrigerant circuit from continued evaporation.

## 1.3 Safety measures when working on vehicles with a start/stop system

### Risk of injury due to unexpected motor start

If the vehicle's start/stop system is activated, the engine can start unexpectedly. A message in the dash panel insert indicates whether the start/stop system is activated.

- Deactivate start/stop system by switching off the ignition.

## 1.4 Safety measures when using air conditioner service stations

- Before connecting the charging system to the air conditioner, make sure that all existing shut-off valves are closed.
- Before the air conditioner service station is decoupled from the air conditioning system, ensure that the process is complete. This will prevent any more refrigerant than necessary and technically unavoidable from entering the atmosphere.
- Once the purified refrigerant from the air conditioner service station /extraction system has been filled into an external compressed-gas cylinder, close the hand shut-off valves at the cylinder and charging system.
- Do not expose the air conditioner service station , extracting and charging system to moisture and do not use in a damp environment.
- Before performing any maintenance work on the air conditioner service station , disconnect the extracting and charging system from the power supply.
- To reduce the risk of fire, avoid using an extension cable. If the use of an extension cable is unavoidable, use an extension cable with a cross-section of at least 2.5 mm<sup>2</sup>.
- In case of fire, remove external cylinder.
- If oil is drawn out of the air conditioning system by the suction accumulator of the air conditioner service station and emptied into the supplied measuring beaker, ensure that it is poured into a sealable container afterwards as the oil could contain a small amount of refrigerant. Refrigerant must not be released into the environment.



- When the air conditioner service station is switched off, take measures to prevent it from rolling away.

**Only keep or use the air conditioner service station with R1234yf refrigerant in cool, well-ventilated areas**

- Protect against heat and direct sunlight, do not keep or use in areas with temperatures higher than 50°C.
- Do not keep or use in or near cellars or other low lying areas.
- Only keep or use in areas with a sufficient flow of air (complete air exchange at least once per hour in workshop area and three times per hour in low lying areas, e.g. inspection pits).

## **1.5 Safety measures for working on vehicles with high-voltage system**

### **Danger to life from high voltage**

The high-voltage system is under high voltage. Severe or fatal injury from electric shock.

- Persons with life-preserving or other electronic medical devices in or on their body must not perform any work on the high-voltage system. Such medical devices include internal analgesic pumps, implanted defibrillators, pacemakers, insulin pumps and hearing aids.
- The high-voltage system must be de-energised by a suitably qualified technician.

### **Risk of injury due to unexpected motor start**

On electric and hybrid vehicles, it can easily be missed that the vehicle is in „ready“ mode. There is a risk of parts of the body becoming trapped or drawn in.

- Switch off ignition.
- Always store the ignition key outside the vehicle.

### **Risk of damage to high-voltage cables**

Improper handling of high-voltage cables or high-voltage connectors can result in damage to their insulation.

- Never support body weight on high-voltage cables or high-voltage connectors.
- Never support any tools on high-voltage cables or high-voltage connectors.
- Never kink or severely bend high-voltage cables.
- Always observe the coding when connecting high-voltage connectors.

### **Risk of injury from activate stationary air conditioning**

On electric and hybrid vehicles with active stationary air conditioning, the stationary air conditioning could switch on unintentionally. Risk of limbs becoming trapped or drawn in by the radiator fan starting automatically.



- Deactivate the stationary air conditioning.

## 1.6 Safety precautions when working in the vicinity of high-voltage components

### Danger to life from high voltage

The high-voltage system is under high voltage. Damage to high-voltage components can result in severe or fatal injury from electric shock.

- Perform visual check of high-voltage components and high-voltage cables.
- Never use cutting or forming tools, or any other sharp-edged tools.
- Never use heat sources such as welding, brazing, soldering, hot air or thermal bonding equipment.

## 1.7 Safety measures when working on pressurised tanks/containers

### Risk of fatal injury and explosion from sources of ignition

Risk of fatal injury and explosion from sources of ignition in the vicinity of air conditioning systems and refrigerant tanks. Escaping refrigerant could ignite and cause an explosion. Risk of explosion leading to loss of life or serious injuries.

- Never bring sources of ignition close to air conditioning systems and refrigerant tanks.
- Avoid electrostatic discharge, sparks from tools striking surfaces and hot surfaces.





## 2 Legal texts and regulations

⇒ [“2.1 Provisions and directives”, page 5](#)

⇒ [“2.2 Charging refrigerant circuit with different refrigerants”, page 6](#)

⇒ [“2.3 Workplace safety”, page 7](#)

### 2.1 Provisions and directives



#### Note

- ◆ *The laws and regulations listed below are valid in Germany. Other or additional laws and regulations may apply in other countries.*
- ◆ *The effects concerning the changing climate can be seen world-wide. Protection of the climate is therefore one of the most important roles of the human race. This role is a huge challenge for all concerned.*
- ◆ *The so called Kyoto Protocol defines, among other things, world-wide targets to protect the climate. Aside from reduction targets for carbon dioxide, this protocol defines reduction targets for fluoride containing greenhouse gases e.g. for refrigerant R134a owing to the high greenhouse potential.*
- ◆ *The cut-off date for bringing vehicles that were type approved before 2011 into operation for the first time with R134a refrigerant is 31.12.2016 (this applies to countries within the EU, different regulations may apply in countries outside the EU). From 01.01.2017, vehicles must not be newly commissioned in countries of the EU unless their refrigerant circuit is charged with refrigerant with a global warming potential less than 150. R1234yf refrigerant meets the requirements of Regulation (EC) No. 706/2007.*

Within Europe, for example, a large number of relevant statutes have been introduced for the motor industry. In Germany, for example, the climate protective regulation concerning chemicals came into force from the 1st of August 2008 in addition to European legislation.

In the European Community, various regulations directives for handling refrigerant have been introduced e.g.:

- ◆ Regulation (EC) No. 1005/2009
- ◆ Regulation (EC) No. 2037/2000
- ◆ Regulation EU No. 517/2014
- ◆ Regulation (EC) No. 706/2007
- ◆ Regulation (EC) No. 307/2008
- ◆ Directive 2006/40/EC

In Germany, additional regulations concerning refrigerant have been introduced e.g.:

- ◆ Climate Protection Regulation Concerning Chemicals (Chemikalien-Klimaschutzverordnung), Closed Substance Cycle Waste Management Law (Kreislaufwirtschaftsgesetz, KrWG),
- ◆ Technical Regulations for Compressed Gases (Technische Regeln Druckgase, TRG).



#### Note

*The R1234yf refrigerant is currently not referenced in the various rules and regulations. Due to its chemical composition, however, it can be assumed that it will be included the next time the relevant rules and regulations are revised. The rules and regulations pertinent to the R134a refrigerant are therefore to be observed and adhered to when handling the R1234yf refrigerant.*

#### Maintenance and repairs to refrigerant circuits for air conditioning systems

Only persons who are deemed to be competent in accordance with Regulation (EC) No. 307/2008 may carry out repairs and service work on the refrigerant circuit of an air conditioning system (applies to countries in which this regulation is valid - different rules and regulations may apply in other countries).

In general the following applies:

Operation, maintenance, decommissioning, duty to accept returned material

- ◆ It is prohibited to allow the release into the atmosphere of materials contained in products containing refrigerants during the operation, maintenance or removal from service of such products.
- ◆ Records must be kept about the quantity used during operation and repair work so that, if necessary, a schedule of application can be presented to the relevant authorities on request. A record sheet need no longer be kept within the EU due to respective European parliament legislation from 2005. Other legislation may apply in countries not belonging to the EU.
- ◆ Companies that sell materials and preparations listed in the above mentioned legislation have a duty to accept returned materials and preparations after they have been used, or to ensure that a specified third party will accept them.
- ◆ Maintenance work and decommissioning of products that contain refrigerant referred to in the above mentioned legislation. The returned substances and preparations referred to in this legislation may also only be accepted by persons who have the necessary specialist knowledge and technical equipment.

#### Closed Substance Cycle Waste Management Law (Kreislaufwirtschaftsgesetz, KrWG) as well as processing and disposing of contaminated refrigerant and refrigerant oil

The respective rules and regulations of the country must be observed here.

## 2.2 Charging refrigerant circuit with different refrigerants

Air conditioning systems developed and designed for R1234yf refrigerant cannot simply be charged with a different refrigerant, e.g. R134a.



#### Note

*According to current legislation, R134a refrigerant must not be charged in vehicles that were type approved for R1234yf refrigerant.*



## 2.3 Workplace safety

- ◆ Regulations on general health and safety according to the VBG (German organisation of trade associations (employers' liability insurance association)) e.g. VGB 20 Accident prevention regulation (UVV) for "Refrigerant systems, heat pumps and cooling equipment" and VGB 1 "General regulations and obligations of the company" and "Obligations of the insured party".
- ◆ Observe the work instructions relevant to the place of work.
- ◆ Only persons who are deemed to be competent in accordance with Regulation (EC) No. 307/2008 may carry out repairs and service work on the refrigerant circuit of an air conditioning system (applies to countries in which this regulation is valid - different rules and regulations may apply in other countries).



### 3 Repair instructions

⇒ ["3.1 Rules for cleanliness", page 8](#)

⇒ ["3.2 Refrigerant circuit seals", page 8](#)

⇒ ["3.3 Refrigerant and refrigerant oil", page 9](#)

⇒ ["3.4 Handling pressurised tanks/containers", page 11](#)

⇒ ["3.5 Handling refrigerants", page 12](#)

#### 3.1 Rules for cleanliness

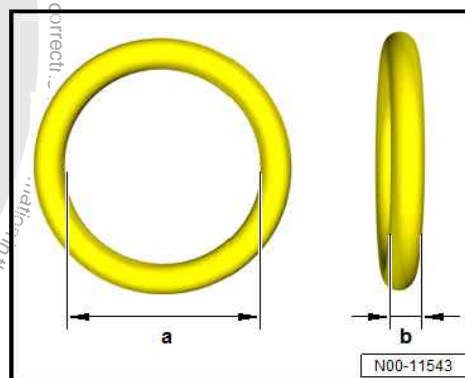
Even small amounts of contamination/soiling can lead to defects. Therefore, observe the following rules for cleanliness when working on the air conditioning system:

- ◆ Seal open pipes and connections immediately with clean plugs, for example from the engine bung set - VAS 6122- .
- ◆ Place removed parts on a clean surface. Cover with lint-free cloths only.
- ◆ If repair work cannot be performed immediately, carefully cover or seal components.
- ◆ Install only clean parts; do not remove new parts from packaging until immediately before installing. Do not use parts that have been stored outside their packaging (e.g. in tool boxes).
- ◆ If system is open, do not work with compressed air.
- ◆ Protect disconnected electrical connections from dirt and water and only reconnect in dry condition.

#### 3.2 Refrigerant circuit seals

- ◆ Renew seals after removal.
- ◆ Moisten seals with refrigerant oil before installing.
- ◆ Ensure proper seating of seals on the pipe or in the groove.
- ◆ Work in a completely clean environment. Even the smallest contaminants, e.g. a hair, can cause leaks.
- ◆ Install only seals resistant to refrigerant R1234yf and respective refrigerant oil ⇒ Electronic parts catalogue (ETKA) .

The dimensions -a- and -b- depend on the fitting location of the seal ⇒ Electronic parts catalogue (ETKA) .





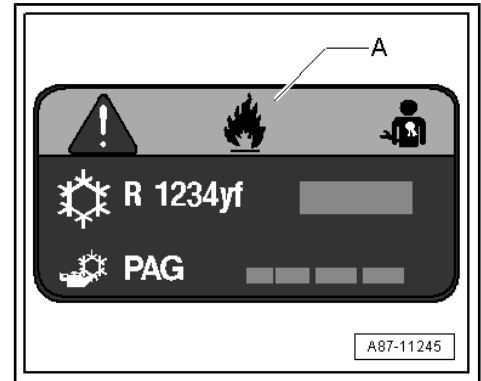
### 3.3 Refrigerant and refrigerant oil

⇒ [“3.3.1 Important repair instructions for refrigerant and refrigerant oil”, page 9](#)

⇒ [“3.3.2 Refrigerant oil”, page 9](#)

#### 3.3.1 Important repair instructions for refrigerant and refrigerant oil

- An air conditioner designed for R1234yf refrigerant must never be charged with R134a refrigerant.
- An air conditioner designed for R134a refrigerant must never be charged with R1234yf refrigerant.
- The refrigerant oils especially developed for refrigerant circuits with R1234yf and R134a refrigerant may not be used in a refrigerant circuit charged with a different refrigerant unless the relevant permissions have been granted ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data; refrigerant oil .
- Air conditioner service stations which come in contact with refrigerant may only be used for the target refrigerant.
- A label -A- is attached in the engine compartment to the lock carrier or the plenum chamber to provide information on the refrigerant used.
- Different refrigerants must never be mixed.
- Depending on the type and production period, it may also indicate the GWP for the refrigerant used.
- To ensure that only R1234yf refrigerant with a certain purity level is drawn into the air conditioner service station (R1234yf), a gas analysis must be performed before the refrigerant circuit is emptied  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#) .



#### Note

*If, during the gas analysis, it is found that the R1234yf refrigerant is contaminated with a different gas, it must be extracted from the refrigerant circuit and analysed, processed or disposed of as gas of unknown composition in accordance with the legal requirements ⇒ VW / Audi ServiceNet ,*

*⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#) and  
⇒ [“6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal”, page 25](#) .*

#### 3.3.2 Refrigerant oil

##### CAUTION

**Risk of chemical burns from atomised refrigerant oil. Eyes and other parts of the body could be injured.**

- Wear protective gloves.
- Wear protective goggles.
- Never inhale atomised refrigerant oil.

- ◆ Refrigerant oil mixes with the refrigerant (about 10 to 40%, depending on compressor type and amount of refrigerant) and circulates constantly in the system, lubricating the moving parts.



- ◆ Special synthetic refrigerant machine oils such as polyalkylene glycol (PAG) oil with certain additives adapted to the refrigerant oil are used in conjunction with R1234yf air conditioning systems. This is necessary because e.g. mineral oil does not mix with R1234yf and, should the additives be missing, undesired reactions with the refrigerant or components of the refrigerant circuit could occur. In addition, the components of the R1234yf air conditioning system could be attacked if the mixture circulated within the refrigerant circuit under pressure and at high temperatures, or the lubricant film in the air conditioner compressor broke down. The use of non-approved oils can lead to failure of the air conditioning system. Therefore, use only approved refrigerant oils ⇒ Electronic parts catalogue .
- ◆ Type of oil for R1234yf refrigerant in motor vehicles: PAG oil with specific additives adapted to R1234yf refrigerant (polyalkylene glycol with certain additives).
- ◆ The most important properties are high solubility with refrigerant, good lubricating quality, absence of acid and low water content. For this reason, only very specific oils may be used. List of approved refrigerant oils and capacities ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).
- ◆ The PAG oils suitable for refrigerant R1234yf are heavily hygroscopic and cannot always be mixed with other oils. Therefore, only use approved refrigerant oils.
- ◆ Moisture and acids promote ageing of refrigerant oil, causing it to become dark, viscous and aggressive towards metals. Containers for refrigerant oil should therefore be kept closed to prevent the ingress of moisture. When containers are opened, they should be closed again immediately.
- ◆ Disposal of used oils: Volkswagen InfoNet; Operation; Handbooks & dealer literature; Handbook Service; 15. Environmental protection; under general instructions follow the link "Environmental protection in the dealership and in the workshop"; 4. Waste disposal; 6. Disposal channels; Disposal of used oils; Refrigerant oils
- ◆ For refrigerant circuits with R1234yf refrigerant circuit, only approved oils may be used for this refrigerant and the air conditioner compressor installed in the system ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data .
- ◆ Refrigerant oil that was developed for R134a refrigerant is not suitable for refrigerant circuits with R1234yf refrigerant (as it is missing specific additives). Therefore, ensure that the correct type is used ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data; Refrigerant oil .
- ◆ Refrigerant oil that was developed for R1234yf refrigerant could also be suitable for use in refrigerant circuits with R134a refrigerant. Observe notes ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).



#### Note

- ◆ *The cylinder in which the refrigerant oil is supplied has a label from which the expiry date of the refrigerant oil can be gleaned.*
- ◆ *This expiry date is not critical if the cylinder is sealed tight.*
- ◆ *Refrigerant oil from a tightly sealed cylinder can also be used after the expiry date specified on the cylinder.*



#### Note

- ◆ *Do not store refrigerant oils open to the atmosphere as they are very hygroscopic (they readily absorb water).*
- ◆ *Always keep the refrigerant oil container and the refrigerant circuit sealed.*
- ◆ *Do not use ester oils (POE oils) as these are currently only compatible with larger systems under different operating conditions (not suitable for motor vehicle air conditioning systems).*

### 3.4 Handling pressurised tanks/containers

**Keep containers tightly sealed in a well ventilated, cool location.**

Refrigerant is heavier than air. Should gas escape from a system, it collects at ground level in particular.

Protect against heat and direct sunlight, do not keep in areas with temperatures higher than 50°C.

Do not keep in or near cellars or other low lying areas.

Only keep in areas with an adequate flow of air.

**Keep containers away from sources of ignition.**

Smoking is forbidden in areas in which R1234yf refrigerant is kept. Also take measures to prevent electrostatic discharge.

**Secure containers to prevent them falling over.**

Secure upright cylinders to stop them falling over and cylinders lying flat to stop them rolling away.

**Containers must never be thrown.**

If they should fall, the containers may become severely deformed and break open. The refrigerant evaporates immediately, liberating considerable force. Flying fragments of cylinders can cause severe injuries.

**To protect cylinder valves, cylinders are only to be transported with a protective cap screwed on.**

Valves may break off if cylinders are not properly transported.

**Do not place near radiators!**

High temperatures can occur near radiators. High temperatures are also associated with high pressures and the maximum permissible tank pressure may be exceeded.

**Do not heat up above 50°C**

To mitigate any risk, the pressure vessel regulations stipulate that tanks/containers must not be heated up above 50°C.





## Do not expose to uncontrolled heat

Do not heat with a naked flame under any circumstances. The local overheating that will result can change the structure of the container's materials, thereby reducing the safe maximum pressure limit of the container. There is also a danger of the refrigerant decomposing due to localised overheating.

## Seal empty tanks/containers

Empty refrigerant tanks/containers must always be closed to prevent the ingress of moisture. Moisture causes steel tanks/containers to rust. Rust weakens the tank/container walls. In addition, rust particles which ingress into refrigeration systems from tanks/containers cause malfunctions.

## 3.5 Handling refrigerants



### Note

- ◆ *Refrigerant has no perceptible odour and usually remains unnoticed.*
- ◆ *Refrigerant gas is heavier than air. It collects in low lying areas, such as inspection pits, cellars and troughs or hollows, where it displaces the ambient air along with the oxygen. Spending time in areas starved of oxygen can be fatal.*
- ◆ *If liquid refrigerant escapes e.g. from a leak, it vaporises at an ambient pressure of about 1 bar at approx. -29.4°C. If refrigerant vaporises on the skin, the result will be frost bite or freeze burns. Sensitive body parts, such as the cornea and mucous membranes, are especially at risk. Larger freeze burns could lead to loss of life.*
- ◆ *Refrigerant gas is inflammable: electrostatic discharge, sparks from striking tools, hot surfaces and naked flames could ignite a mixture of R1234yf refrigerant and ambient air. However, refrigerant only burns if supported by a flame, or if it is in the vicinity of a hot surface. It extinguishes when it is no longer supported e.g. by a flame.*
- ◆ *Refrigerant decomposes when exposed to a flame or in contact with a hot surface. Danger of poisoning on inhaling poisonous decomposed products. A pungent odour indicates that the products of decomposition are already present. Breathing in these substances must be avoided in all circumstances, or the bronchial tubes, lungs and other organs could be injured.*
- ◆ *The specific risks of refrigerant, material data etc. can be gleaned from the safety data sheets. Safety data sheets about refrigerant, refrigerant oil etc. can be found on the ⇒ VW ServiceNet .*
- Do not weld, braze or soft-solder any parts of the charged air conditioning system. This also applies to welding and soldering work on the vehicle when the danger exists that parts of the air conditioning system may heat up. When spray painting is carried out, temperatures of objects in the drying booth or the preheating zone must not exceed 80°C.

### Reason:

Heating causes great excess pressure to develop in the system, which can cause the pressure release valve of the system to open.

### Remedy:

- Empty refrigerant circuit with air conditioner service station  
⇒ [page 123](#) .





#### Note

*Do not repair damaged or leaking parts of the air conditioner by welding or soldering. These must be renewed.*

Refrigerant containers (e.g. charging cylinders of air conditioner service station ) must never be subjected to excessive heat or exposed to direct sunlight.

#### Reason:

Refrigerant expands as it heats up.

#### Remedy:

- When charging and storing compressed gas containers (returnable cylinders, recycling cylinders etc.), observe the applicable regulations, technical rules and legislation.
- Containers must never be completely filled with liquid refrigerant. Without sufficient expansion space (gas cushion), the container will burst should the temperature rise with devastating consequences ➔ [“6.2 Physical properties”, page 19](#) .

Under no circumstances may refrigerant be charged into systems or vessels containing air.

#### Remedy:

- Evacuate systems and containers before charging with refrigerant ➔ [page 123](#) .





## 4 Identification

⇒ **"4.1 Notice for refrigerant circuit", page 14**

### 4.1 Notice for refrigerant circuit

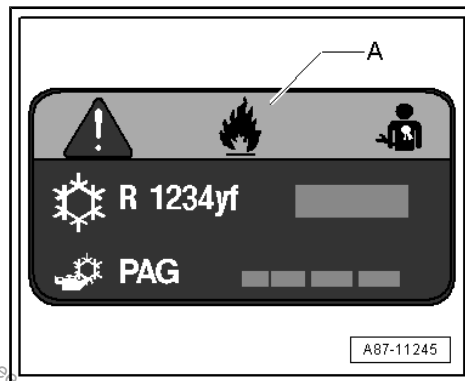
- ◆ The notice -A- provides details about the type of refrigerant, the volume of refrigerant charged in the system during production and which refrigerant oil is used.
- ◆ Symbols on the notice -A- indicate the risks that might be encountered when handling refrigerant and when working on the refrigerant circuit.
- ◆ In addition, it may specify standards, e.g. specific SAE standards that are valid in the USA. SAE J639 describes the safety instructions for air conditioning systems in passenger cars. SAE J842 describes that only components and materials approved for R1234yf refrigerant may be used, while SAE J2845 indicates that only trained and certified persons may carry out repairs and service work on the refrigerant circuit of an air conditioning system.
- ◆ Depending on the type and production period, it may also indicate the GWP for the refrigerant used.
- ◆ The capacities and type of refrigerant oil marked on the notice -A- indicate the status during production of the vehicle. The latest applicable values should always be gleaned from the vehicle-specific workshop manual ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).



#### Note

*The country-specific legislation, regulations and standards must be obeyed independently of the details on the notice -A-. In the area of the European Union, e.g. the applicable EC regulations*  
⇒ **"2 Legal texts and regulations", page 5**

With details about the type of refrigerant and specified capacity  
⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).





## 5 Technical data

⇒ ["5.1 Refrigerant capacity", page 15](#)

⇒ ["5.2 Refrigerant oil capacities", page 15](#)

⇒ ["5.3 Safety data sheets", page 15](#)

### 5.1 Refrigerant capacity

The capacities of R1234yf refrigerant can be found in the vehicle-specific workshop manual ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data; R1234yf refrigerant capacities .

### 5.2 Refrigerant oil capacities

The capacities of refrigerant oil can be found in the vehicle-specific workshop manual ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data; Refrigerant oil.

### 5.3 Safety data sheets

Safety data sheets are currently available on the ⇒ VW / Audi ServiceNet .



## 6 Basic technical and physical properties

⇒ [“6.1 Basics of air conditioning technology”, page 16](#)

⇒ [“6.2 Physical properties”, page 19](#)

⇒ [“6.3 Product characteristics”, page 26](#)

⇒ [“6.4 Function and role of air conditioning system”, page 26](#)

⇒ [“6.5 Other reference material”, page 28](#)

### 6.1 Basics of air conditioning technology

⇒ [“6.1.1 Physical properties of air conditioning system”, page 16](#)

⇒ [“6.1.2 Pressure and boiling point of refrigerant”, page 17](#)

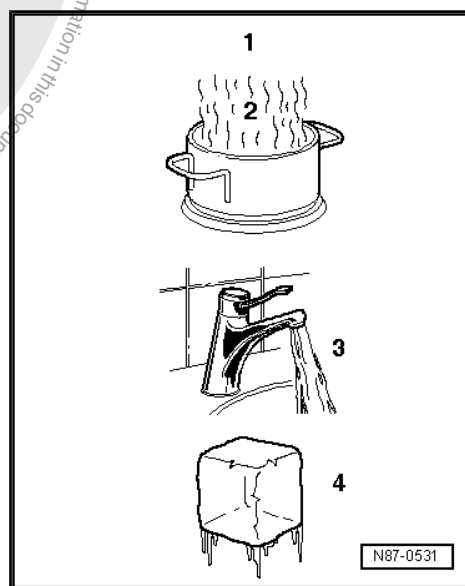
⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 17](#)

⇒ [“6.2 Physical properties”, page 19](#)

#### 6.1.1 Physical properties of air conditioning system

The 4 familiar states of water apply to air conditioning refrigerants as well.

- 1 - Gas (invisible)
- 2 - Vapour
- 3 - Liquid
- 4 - Solid



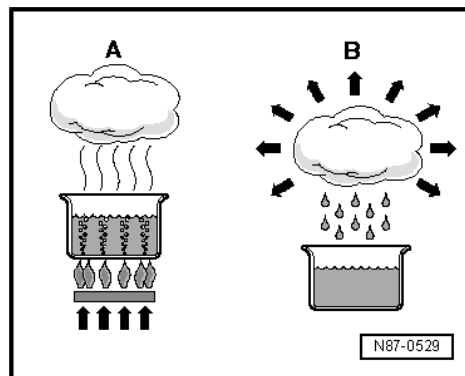
When water is heated in a vessel (heat absorption), water vapour can be seen to rise. If the vapour is heated by further heat absorption, the visible vapour becomes invisible gas. The process is reversible. If heat is extracted from gaseous water -A-, it changes first to vapour -B-, then to water and finally to ice.

A - Heat absorption

B - Heat dissipation

**Heat always flows from a warmer to a colder substance**

Every substance consists of a mass of moving molecules. The fast moving molecules of a warmer substance give off some of their energy to the cooler and thus slower molecules. As a result, the molecular motion of the warmer substance slows down and that of the colder substance is accelerated. This continues until the molecules in both materials are moving at the same speed. They are then at the same temperature and no further heat exchange takes place.





## 6.1.2 Pressure and boiling point of refrigerant

The boiling point given in tables for a liquid is always referenced to atmospheric pressure (1 bar absolute pressure). If the pressure over a fluid changes, its boiling point changes as well.



### Note

Pressure is indicated in various units: 1 MPa (Mega-Pascal) is equal to 10 bar or 145 psi; 1 bar absolute pressure is equal to 0 bar, which is about the same as ambient pressure (atmospheric pressure).

It is well known that e.g. the lower the pressure, the lower the temperature at which water boils.

The vapour pressure curves for water and for R1234yf refrigerant show that at constant pressure and falling temperature the vapour becomes liquid (in the condenser), and that when pressure drops, for example, the refrigerant changes from liquid into the vaporous state (in the evaporator).

Vapour curve, water

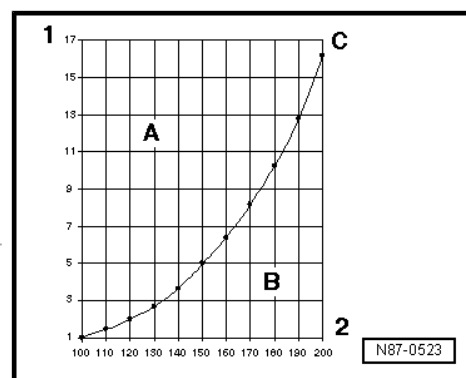
A - Liquid

B - Gaseous

C - Vapour curve, water

1 - Pressure on the liquid in bar (absolute)

2 - Temperature in °C



Vapour pressure curve for refrigerant R1234yf

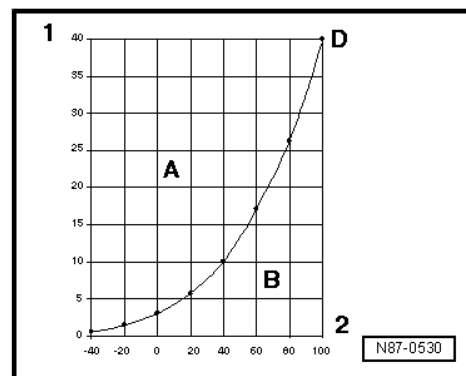
A - Liquid

B - Gaseous

D - Vapour pressure curve for refrigerant R1234yf

1 - Pressure on the liquid in bar (absolute)

2 - Temperature in °C



### Note

The vapour pressure curves of both refrigerants, R1234yf and R134a, are very similar across a broad temperature range. The pressure difference between the two refrigerants in a temperature range of 0 °C to +50 °C is only about 0.2 bar, for example, which is why it is not possible to differentiate between the two refrigerants ⇒ ["6.1.3 Vapour pressure table for refrigerant", page 17](#) and ⇒ [Air conditioning system with R134a refrigerant; Rep. gr. 87](#) ; General information about the air conditioning system and refrigerant circuit . It is only possible to determine a difference using relevant sensors, which can analyse the chemical structure of the refrigerant  
⇒ ["6.2.16 Analysis of refrigerant R1234yf", page 24](#) .

## 6.1.3 Vapour pressure table for refrigerant

The vapour pressure table for every refrigerant is published in literature for refrigeration system engineers. This table makes it



possible to determine the vapour pressure acting on the column of liquid in a vessel if the temperature of the vessel is known.

Since its own characteristic vapour pressure table is known for each refrigerant, it is possible to establish the type of refrigerant by measuring the pressure and temperature of refrigerants whose vapour pressure changes over a certain temperature range (does not apply when differentiating between R1234yf and R134a as the vapour pressures are too close

⇒ ["6.1.2 Pressure and boiling point of refrigerant", page 17](#) ).



#### Note

- ◆ *The means of differentiation are only given for pure refrigerants whose vapour pressures differ sufficiently. If different refrigerants are mixed for form a new refrigerant (e.g. 3 different refrigerants to form R407C refrigerant), a vapour pressure will be created in accordance with the vapour pressures of the individual refrigerants and their percentage in the mixture.*
- ◆ *Absolute pressure means that "0 bar" corresponds to an absolute vacuum. The normal ambient pressure corresponds to "1 bar" absolute pressure. On most pressure gauges, a reading of "0 bar" corresponds to an absolute pressure of one bar (which is confirmed by the existence of a "-1 bar" marking beneath the "0" scale marking).*
- ◆ *Pressure is indicated in various units: 1 MPa (Mega-Pascal) is equal to 10 bar or 145 psi; 1 bar absolute pressure is equal to 0 bar, which is about the same as ambient pressure (atmospheric pressure).*
- ◆ *The vapour pressures of the two refrigerants, R1234yf and R134a, are very similar across a broad temperature range, which is why no difference can be established between them  
⇒ Air conditioning system with R134a refrigerant, General information about the air conditioning system . It is only possible to determine a difference using relevant sensors, which can analyse the chemical structure of the refrigerant  
⇒ ["6.2.16 Analysis of refrigerant R1234yf", page 24](#) .*

Temperature in °C	Pressure in bar (positive pressure) R1234yf
-40	-0.40
-30	-0.01
-25	0.12
-20	0.50
-15	0.83
-10	1.21
-5	1.65
0	2.15
5	2.72
10	3.36
15	4.09
20	4.90
25	5.81
30	6.82
35	7.93
40	9.17
45	10.52



Temperature in °C	Pressure in bar (positive pressure) R1234yf
50	12.01
55	13.64
60	15.41
65	17.35
70	19.46
75	21.75
80	24.24
85	26.94
90	29.09

## 6.2 Physical properties

- ⇒ [“6.2.1 R1234yf refrigerant”, page 19](#)
- ⇒ [“6.2.2 Potential risks with R1234yf refrigerant”, page 20](#)
- ⇒ [“6.2.3 Physical and chemical properties of R1234yf refrigerant”, page 20](#)
- ⇒ [“6.2.4 Critical point”, page 20](#)
- ⇒ [“6.2.5 Environmental aspects of refrigerant R1234yf”, page 21](#)
- ⇒ [“6.2.6 Trade names and designations of R1234yf refrigerant”, page 21](#)
- ⇒ [“6.2.7 Colour and odour of R1234yf refrigerant”, page 22](#)
- ⇒ [“6.2.8 Vapour pressure of R1234yf refrigerant”, page 22](#)
- ⇒ [“6.2.9 Physical properties of R1234yf refrigerant”, page 22](#)
- ⇒ [“6.2.10 How R1234yf refrigerant reacts to metals and plastics”, page 22](#)
- ⇒ [“6.2.11 Critical temperature / critical pressure of R1234yf refrigerant”, page 23](#)
- ⇒ [“6.2.12 Water content of R1234yf refrigerant”, page 23](#)
- ⇒ [“6.2.13 Flammability / decomposition of R1234yf refrigerant”, page 23](#)
- ⇒ [“6.2.14 Charge factor of refrigerant R1234yf”, page 23](#)
- ⇒ [“6.2.15 Evidence of leaks in a refrigerant circuit with R1234yf refrigerant”, page 24](#)
- ⇒ [“6.2.16 Analysis of refrigerant R1234yf”, page 24](#)
- ⇒ [“6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal”, page 25](#)

### 6.2.1 R1234yf refrigerant

- ◆ Air conditioners in vehicles employ the evaporation and condensation process. A substance (the refrigerant) is moved about a circuit within an enclosed system.
- ◆ The substance is one that has a low boiling point, in this instance R1234yf refrigerant.
- ◆ The R1234yf refrigerant is marketed under various names (e.g. HFO 1234yf, Opteon 1234yf etc.).





- ◆ For the air conditioning system, only approved refrigerant with the requisite level of purity may be used  
⇒ ["6.2.16 Analysis of refrigerant R1234yf", page 24](#) .
- ◆ R1234yf refrigerant is a halogenated hydrocarbon compound with the chemical designation "2,3,3,3-tetrafluoroprop-1-ene" which boils at -29.4 °C at a vapour pressure of "1 bar" (equivalent to ambient pressure).

## 6.2.2 Potential risks with R1234yf refrigerant

- ◆ The refrigerant is flammable with ambient air in a certain mixture ratio  
⇒ ["6.2.3 Physical and chemical properties of R1234yf refrigerant", page 20](#) and  
⇒ ["6.2.13 Flammability / decomposition of R1234yf refrigerant", page 23](#) .
- ◆ Rapid vaporisation of the liquid can cause freezing injuries
- ◆ High vapour concentrations can cause headaches, dizziness, drowsiness and nausea and even loss of consciousness.

## 6.2.3 Physical and chemical properties of R1234yf refrigerant

The following is a list of the main properties and safety information for R1234yf refrigerant. The complete details can be found in the respective safety data sheets on the ⇒ [VW / Audi ServiceNet](#)

Chemical formula	CF <sub>3</sub> CF=CH <sub>2</sub>
Chemical designation	2,3,3,3-tetrafluoroprop-1-ene, HFO-1234yf
Boiling point at 1 bar	-29.4 °C
Solidification point	-152.2 °C
Critical temperature	94.7 °C
Critical pressure	32.82 bar (positive pressure) 33.82 bar (absolute pressure)
Self combustion temperature	405 °C at 1.02 bar (absolute pressure)
Flammability	Flammable gas ◆ Lower explosion threshold 6.2% (volume)  ◆ Upper explosion threshold 12.3% (volume)
Form	Compressed, liquefied gas
Colour	Colourless
Odour	Weak odour

## 6.2.4 Critical point

The critical point (critical temperature and critical pressure) means the point above which there is no longer a surface of separation between liquid and gas.

A substance above its critical point is always in the gaseous state.

At temperatures below the critical point, all types of refrigerant contained within a pressure vessel exhibit a liquid phase and a gas phase, i.e. there is a gas cushion above the liquid.

As long as there is gas in the pressure vessel alongside the liquid, the pressure depends directly on the ambient temperature  
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 17](#) .





#### Note

- ◆ *Refrigerants used in motor vehicles must not be mixed together. Only the refrigerant prescribed for the respective air conditioning system may be used.*
- ◆ *The vapour pressures of the two refrigerants, R1234yf and R134a, are very similar across a broad temperature range, which is why no difference can be established between them  
⇒ Air conditioning system with R134a refrigerant, General information about the air conditioning system . It is only possible to determine a difference using relevant sensors, which can analyse the chemical structure of the refrigerant  
⇒ **"6.2.16 Analysis of refrigerant R1234yf", page 24** .*

### 6.2.5 Environmental aspects of refrigerant R1234yf

- ◆ R1234yf is a fluorocarbon (FC) and contains no chlorine.
- ◆ R1234yf has a shorter atmospheric life than R12 and R134a refrigerant and therefore has a less significant greenhouse effect (lower global warming potential).
- ◆ R1234yf does not damage the ozone layer, the potential to reduce the amount of ozone is zero (as is the case with R134a).
- ◆ The global warming potential (GWP) of R1234yf is 4 (the GWP for carbon dioxide is 1).
- ◆ The contribution of R1234yf towards global warming is lower than the R134a refrigerant by a factor of "350" (GWP of R134a is about 1400).



#### Note

- ◆ *The global warming effect of substances is calculated according to various methods based on their effect over a period of 100 years, which is why the results differ (e.g. R134a has a GWP between 1300 and 1450).*
- ◆ *In order to compare the impact of various greenhouse gases on the earth atmosphere, a calculation is carried out using the carbon dioxide equivalent. The refrigerant R1234yf has a GWP of 4, i.e. 1 kg of this refrigerant has the same impact on the earth atmosphere as 4 kg of carbon dioxide ("CO<sub>2</sub>").*

### 6.2.6 Trade names and designations of R1234yf refrigerant

Refrigerant R1234yf is currently available under the following trade names:

- ◆ H-FKW 1234yf
- ◆ HFO 1234yf
- ◆ "Opteon yf" or "Solstice yf" (examples of company names)



#### Note

- ◆ Different trade names may be used in other countries.
- ◆ Of the wide range of refrigerants available, this is the only one which may be used for vehicles. The names Frigen and Freon are trade names. These also apply to refrigerants which are not to be used in vehicles.

### 6.2.7 Colour and odour of R1234yf refrigerant

- ◆ Like water, refrigerants are colourless in both vapour and liquid form. Gas is invisible. Only the boundary layer between gas and liquid is visible (liquid level in indicator tube of charging cylinder or bubbles in sight glass). Liquid refrigerant R1234yf may have a coloured (milky) appearance in a sight glass. This cloudiness is caused by partially dissolved refrigerant oil and does not indicate a fault.
- ◆ Refrigerant is almost odourless. Should R1234yf refrigerant escape, it may be possible to detect a slight smell of ether depending on the ambient conditions.

### 6.2.8 Vapour pressure of R1234yf refrigerant

In an enclosed container that is not completely full, refrigerant evaporates at the surface in a quantity sufficient to form an equilibrium between vapour and liquid. This state of equilibrium occurs under the influence of pressure and is often called vapour pressure. The vapour pressure is temperature-dependant

⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 17](#) .

### 6.2.9 Physical properties of R1234yf refrigerant

- ◆ The vapour pressure curves of the two refrigerants, R1234yf and R134a, are very similar across a broad temperature range, which is why no difference can be established between them  
⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 17](#) and  
⇒ Air conditioning system with R134a refrigerant, General information about the air conditioning system . It is only possible to determine a difference using relevant sensors, which can analyse the chemical structure of the refrigerant  
⇒ [“6.2.16 Analysis of refrigerant R1234yf”, page 24](#) .
- ◆ Lubrication of the air conditioner compressor with R1234yf is by special synthetic refrigerant oils, e.g. PAG oils (polyalkylene glycol oils) with certain additives adapted to the R1234yf refrigerant oil, the air conditioner compressor and the operating conditions.

### 6.2.10 How R1234yf refrigerant reacts to metals and plastics

- ◆ In its pure state, R1234yf refrigerant is chemically stable and has no corrosive effect on e.g. iron, aluminium and specially developed plastics that are suitable for this purpose.
- ◆ Contaminants in the refrigerant, however, cause components of the refrigerant circuit to become corroded and damaged beyond repair.
- ◆ Unsuitable materials (e.g. seals and hoses that were not developed for the R1234yf refrigerant and the associated refrigerant oil) can also be corroded and damaged by pure R1234yf refrigerant and refrigerant oil.



- ◆ If the refrigerant is contaminated, e.g. with chlorine compounds or by the influence of UV light, metals and also plastics developed and tested for this refrigerant and refrigerant oil can be corroded. This can lead to blockages, leaks and deposits on the air conditioner compressor piston.
- ◆ Certain metals can be corroded by R1234yf refrigerant (e.g. finely distributed aluminium, zinc, magnesium)

### 6.2.11 Critical temperature / critical pressure of R1234yf refrigerant

Up to a gas pressure of 32.82 bar (which is equivalent to a temperature of 94.7°C), refrigerant evaporates at the surface in a quantity that, combined with particles of vapour, returns it to liquid again. Above this temperature / pressure there is no longer a surface separating the liquid and gas.

### 6.2.12 Water content of R1234yf refrigerant

- ◆ Only very small amounts of water are soluble in liquid refrigerant. On the other hand, refrigerant vapour and water vapour mix in any ratio.
- ◆ Any water in the refrigerant circuit will be entrained in droplet form once the dryer in the receiver or reservoir is full (once it has absorbed approx. 7 g of water). This water flows as far as the expansion valve nozzle or the restrictor and turns to ice. The air conditioner no longer provides cooling.
- ◆ If the existing water at the regulating valve of the air conditioner compressor turns to ice, a variety of complaints may be made depending on the design of the air conditioner compressor (either the air conditioning system stops cooling or the air conditioning system cools to such a degree that the evaporator ices over).
- ◆ Water destroys the air conditioner because at high pressures and temperatures it can combine with other impurities to form acids.

### 6.2.13 Flammability / decomposition of R1234yf refrigerant

- ◆ In certain concentrations in the ambient air, R1234yf refrigerant is flammable.
- ◆ R1234yf begins to decompose when exposed to flames and glowing or hot surfaces. Even UV light causes refrigerant to break up (UV light is part of normal sunlight, it is also encountered e.g. during electrical welding), which releases poisonous fission products that must not be inhaled. However, these chemicals irritate the mucous membranes, giving adequate warning of their presence.
- ◆ During decomposition, certain hazardous products such as carbon monoxide, hydrogen fluoride and / or hydrogen halide can be released.

### 6.2.14 Charge factor of refrigerant R1234yf

- ◆ When charging compressed gas containers (returnable cylinders, recycling cylinders etc.), observe the applicable regulations, technical rules and legislation.
- ◆ Never overcharge compressed gas containers (returnable cylinders, recycling cylinders etc.). The gas cushion (expansion space) of overcharged compressed gas containers is too small to accommodate expansion of the fluid caused by a rise in temperature. Risk of bursting.



- ◆ To ensure safety, only use compressed gas containers fitted with a safety valve.
- ◆ Returnable and recycling cylinders must be weighed on suitable scales during charging, or a method of charging by volume must be employed to ensure that the permissible weight of the filling specified on the tank/container is not exceeded. The maximum permissible filling volume is 80% of the maximum refrigerant volume of the filling weight specified on the returnable and recycling cylinder or 70% of the maximum filling volume (charge factor, the smaller of the values always applies respectively). Reason: There is no way of absolutely ruling out refrigerant oil being filled into the returnable and recycling cylinder along with the refrigerant.
- ◆ There must be space both for liquid and vapour in a container. As the temperature rises, the liquid expands. The vapour-filled space becomes smaller. At a certain point, there will only be liquid in the vessel. Beyond this, even a slight increase in temperature causes great pressure to build up in the vessel as the liquid attempts to continue expanding despite the absence of the necessary space. The resultant force is sufficient to rupture the vessel. To prevent containers from being overcharged, regulations governing the storage of compressed gases specify how many kilograms may be charged into a container for every litre of container volume. This charge factor multiplied by the internal volume gives the permissible charge quantity. The charge factor for refrigerant used in vehicles is 1.15 kg/litre.
- ◆ Since contaminated refrigerant could have a different density than pure R1234yf refrigerant, the maximum permissible charge factor must always be observed.

### 6.2.15 Evidence of leaks in a refrigerant circuit with R1234yf refrigerant

- ◆ The refrigerant circuit could develop leaks, for example, from the use of unsuitable or contaminated refrigerant or untested materials in unsuitable components.
- ◆ Since a small leak will involve only small quantities of refrigerant, evidence of leaks should be sought using an electronic leak detector or by introducing a leak detection additive to the refrigerant circuit. Electronic leak detectors can detect leakage rates of less than 5 grams loss of refrigerant per year.



#### Note

*Use must however be made of leak detectors designed for the composition of the respective refrigerant. For example, leak detectors for R12 refrigerant are not suitable for R1234yf refrigerant as these leak detectors do not always respond. Even leak detectors that are designed just for R134a refrigerant are not suitable for R1234yf refrigerant because R1234yf refrigerant has a different chemical structure than R134a. Subsequently, these leak detectors only respond to high concentrations of refrigerant in the air or not at all ⇒ Electronic parts catalogue .*

### 6.2.16 Analysis of refrigerant R1234yf

For operation of the air conditioning system, it is important that the refrigerant used has a certain degree of purity.



#### Note

- ◆ A faulty gas analysis is possible from air in the refrigerant hoses or non-observance of the procedure for gas analysis as detailed in the operating instructions.
- ◆ Carefully follow the operating instructions of the gas analysis device / air conditioner service station .
- ◆ Evacuate refrigerant hoses of the air conditioner service station before connecting the service couplings to the refrigerant circuit/a natural gas fuel tank with refrigerant R1234yf (see operating instructions of the gas analysis device/the air conditioner service station )  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#) .

Contamination with other refrigerants or gases can cause damage and thereby failure of the air conditioning system and air conditioner service station .

Contaminated refrigerant must be analysed and then processed (or disposed of) as gas of unknown composition in accordance with the relevant legal requirements

⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#) .



#### Note

Return contaminated R1234yf refrigerant to your refrigerant supplier for analysis. If, owing to refrigerant circuit damage that has already occurred or is expected, it is necessary for you to know exactly which impurities the refrigerant is contaminated with, submit an application and request analysis results  
⇒ [“6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal”, page 25](#) .

The following thresholds apply for clean R1234yf refrigerant during the gas analysis:

- ◆ At least 95% of the extracted refrigerant gas consist of the refrigerant R1234yf
- ◆ .
- ◆ The percentage of impurities (oxygen, nitrogen, vapour, other refrigerants) is less than 5%.



#### Note

To prevent liquid components (e.g. droplets of refrigerant oil) in the extracted refrigerant gas from falsifying the result of the gas analysis, separators (filters) are installed in the gas analysis device that separate these droplets of liquid. Renew filters in accordance with the specifications in the operating instructions accompanying the gas analysis device and air conditioner service station ⇒ Operating instructions of gas analysis device or ⇒ Operating instructions of air conditioner service station .

## 6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal

- ◆ When returning contaminated refrigerant for analysis, processing/recycling or disposing of refrigerant that is no longer usable, the legal requirements must be observed



- ⇒ [“2 Legal texts and regulations”, page 5](#) and ⇒ VW / Audi ServiceNet .
- ◆ When disposing of refrigerant oil that is no longer usable, the legal requirements must be observed  
⇒ [“2 Legal texts and regulations”, page 5](#) and ⇒ VW / Audi ServiceNet .
  - ◆ To protect the environment, no refrigerant should be released into the atmosphere  
⇒ [“2 Legal texts and regulations”, page 5](#) .
  - ◆ If, during the gas analysis, it is found that the R1234yf refrigerant is contaminated with a different gas, it must be extracted from the refrigerant circuit and returned to your gas supplier to be analysed, processed or disposed of as gas of unknown composition in accordance with the legal requirements ⇒ VW / Audi ServiceNet and  
⇒ [“2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal”, page 155](#) .



#### Note

*Return contaminated R1234yf refrigerant to your refrigerant supplier for analysis. If, owing to refrigerant circuit damage that has already occurred or is expected, it is necessary for you to know exactly which impurities the refrigerant is contaminated with, submit an application by requesting analysis results  
⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .*

## 6.3 Product characteristics

R1234yf refrigerant used in motor vehicle air conditioning systems belongs to the new generation of refrigerants based on chlorine-free, partially fluorinated hydrocarbons.

With regard to their physical properties, these are refrigerants which have been liquefied under pressure. These are subject to the regulations governing pressure vessels and use is only to be made of approved and appropriately marked containers.

Compliance with specific conditions is required to ensure safe and proper use ⇒ [“1 Safety information”, page 1](#) .

## 6.4 Function and role of air conditioning system

⇒ [“6.4.1 Principle of operation”, page 26](#)

⇒ [“6.4.2 Comfort”, page 27](#)

⇒ [“6.4.3 Environmental aspects”, page 27](#)

### 6.4.1 Principle of operation

- ◆ The temperature in the passenger compartment depends on the amount of heat radiated through the windows and conducted by the metal parts of the body. In order to maintain comfortable temperatures for the occupants on very warm days, part of the prevailing heat must be pumped away.
- ◆ Since heat spreads towards cooler bodies, a unit that can create low temperatures is fitted in the vehicle interior. Within this, refrigerant is continually evaporated. The heat required to do this is extracted from the air flowing through the evaporator.
- ◆ The refrigerant carries the heat with it as it is pumped away by the air conditioner compressor. The work performed by the air conditioner compressor on the refrigerant increases its heat





content and its temperature. This is now substantially higher than that of the surrounding air.

- ◆ The hot refrigerant flows with its heat content to the condenser. Here, the refrigerant dissipates its heat to the surrounding air via the condenser due to the temperature gradient between the refrigerant and the surrounding air.
- ◆ The refrigerant thus acts as a heat transfer medium. As it is to be re-used, the refrigerant is returned to the evaporator.
- ◆ For this reason all air conditioning systems are based on the refrigerant circulation principle. There are however differences in the composition of the units  
⇒ ["1.1 System overview - refrigerant circuit", page 30](#) .

## 6.4.2 Comfort

- ◆ A basic requirement for concentration and safe driving is a feeling of comfort in the passenger compartment. This comfort is only reached by using an air conditioning system, particularly when it is hot and humid. Of course, open windows, an open sunroof or increased air ventilation can contribute to comfort, but they all have certain disadvantages within the vehicle interior, such as additional noise, draughts, exhaust gases, unhindered entry of pollen (unpleasant for allergy sufferers).
- ◆ A well regulated air conditioning system in conjunction with a well thought-out heating and ventilation system can create a feeling of well-being and comfort by regulating the interior temperature, humidity and rate of air change, regardless of the external conditions. This must be available whether the vehicle is moving or not.

Other important advantages of air conditioning are:

- ◆ Drying of the air in the passenger compartment (humidity in the air condenses on the cold evaporator and is drained away as condensate, the air is heated up again on the heat exchanger for heater to a preset temperature, which reduces the water content in the air and the absolute and relative humidity is reduced).
- ◆ Additional cleansing of the air directed into the passenger compartment (dust and pollen that have made their way passed the dust and pollen filter, for example, are washed out by the moist fins of the evaporator and carried off with the condensation water.)
- ◆ Temperatures in a mid-range car (for example, after a short period of driving, ambient temperature 30°C in the shade and the vehicle in direct sunlight).

	With air conditioning	Without air conditioning
Head height	23 °C	42 °C
Chest	24 °C	40 °C
Footwell	30 °C	35 °C

## 6.4.3 Environmental aspects

- ◆ Until about 1992, air conditioning systems were equipped with refrigerant R12. Due to its chlorine atoms, this CFC had a high potential for destroying ozone and, in addition, a very high potential for increasing the greenhouse effect.
- ◆ From 1992, the air conditioning systems of newly manufactured cars have been successively changed from R12 refrigerant to R134a refrigerant. This refrigerant contains no chlorine and therefore does no damage to the ozone layer.



Due to the high global warming potential of approx. 1400 (GWP), it may no longer be used in vehicles that are newly type approved from 2011. The cut-off date for bringing vehicles that were type approved before 2011 into operation for the first time with R134a refrigerant is 31.12.2016 (this applies to countries within the EU, different regulations may apply in countries outside the EU).

- ◆ After 01.01.2011, vehicles will only be given a new type approval if the refrigerant used in the refrigerant circuit of their air conditioning system has a GWP of less than 150. R1234yf refrigerant has a GWP of approx. 4 and is therefore markedly below the prescribed level.
- ◆ From 2011, the air conditioning systems of newly manufactured cars have been successively changed from R134a refrigerant to R1234yf refrigerant. This refrigerant has a global warming potential of approx. 4. The GWP of carbon dioxide = 1 (global warming potential) and has much less of an impact on the earth's atmosphere than R134a refrigerant.
- ◆ Conversion programmes have been developed for old systems filled with the ozone-depleting substance R12 ⇒ Workshop manual for air conditioners with R12 refrigerant (this workshop manual is available in paper form only).
- ◆ According to current legislation, R134a refrigerant may still be charged in vehicles that were type approved for use with R134a refrigerant (or in vehicles converted from R12 refrigerant to R134a refrigerant) until these vehicles are decommissioned. No provision has currently been made, therefore, to convert air conditioning systems from R134a refrigerant to R1234yf refrigerant ⇒ Air conditioning systems with R134a refrigerant; Rep. gr. 87 ; Capacities for R134a refrigerant, refrigerant oil and approved refrigerant oils .
- ◆ To protect the environment, no refrigerant should be released into the atmosphere  
⇒ ["2 Legal texts and regulations", page 5](#) .
- ◆ R1234yf refrigerant is chemically stable in an enclosed system. In the earth's atmosphere, however, it decomposes within a short space of time (within approx. 14 days) by the influence of UV light into compounds that do not harm the earth's atmosphere (hence the GWP of 4).

## 6.5 Other reference material

- ◆ Workshop manual for model-specific maintenance work ⇒ Heating, air conditioning system; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual) and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations
- ◆ Technical Service Handbook with measures for rectifying latest malfunctions
- ◆ Self-study Programmes, videos for workshop training and VW/ Audi TV episodes on the air conditioning system.
- ◆ The specific risks of refrigerant, material data etc. can be gleaned from the safety data sheets. Safety data sheets about refrigerant, refrigerant oil etc. ⇒ VW / Audi ServiceNet .
- ◆ List of relevant special tools and workshop equipment for repairs to air conditioning systems ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Heating, air conditioning system).
- ◆ Information about the disposal of refrigerant oil and contaminated refrigerant can be found on ⇒ VW / Audi ServiceNet .
- ◆ For vehicles whose refrigerant circuit is charged with R134a refrigerant (vehicles that were type approved before





31.12.2010 and have been or are to be commissioned for the first time by 31.12.2016

⇒ ["2 Legal texts and regulations", page 5](#) .





## 87 – Air conditioning system

### 1 Refrigerant circuit

⇒ [“1.1 System overview - refrigerant circuit”, page 30](#)

⇒ [“1.2 General description - components of refrigerant circuit”, page 35](#)

⇒ [“1.3 Possible complaints”, page 63](#)

⇒ [“1.4 Investigating leaks”, page 67](#)

⇒ [“1.5 Renewing components”, page 78](#)

⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#)

⇒ [“1.7 Checking pressures with pressure gauge”, page 120](#)

#### 1.1 System overview - refrigerant circuit

⇒ [“1.1.1 System overview - refrigerant circuit with expansion valve and receiver”, page 30](#)

⇒ [“1.1.2 System overview - refrigerant circuit with restrictor and reservoir”, page 32](#)

⇒ [“1.1.3 System overview - refrigerant circuit with electrically driven air conditioner compressor \(with and without battery cooling module\)”, page 33](#)

##### 1.1.1 System overview - refrigerant circuit with expansion valve and receiver



#### Note

- ◆ The arrows indicate the direction of coolant flow.
- ◆ The following diagram shows an example of a refrigerant circuit with 2 evaporators and one internal heat exchanger.
- ◆ The layout of the refrigerant circuit is specific to the vehicle ➤ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).

HD = High-pressure side

ND = Low-pressure side



**1 - Air conditioner compressor regulating valve - N280-**

**2 - Air conditioner compressor**

**3 - Pulley**

- ☐ Depending on the version, an air conditioning system magnetic clutch - N25- is installed in the belt pulley ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ☐ Depending on the version there may be a drive unit instead of the belt pulley ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

**4 - High-pressure safety valve**

**5 - Refrigerant pressure sender**

- ☐ Vehicle-specific versions ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit .

**6 - Condenser (with receiver)**

**7 - Receiver**

- ☐ Installed on, at or in the condenser ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

- ☐ With desiccant cartridge

**8 - Service connection, high-pressure side**

- ☐ With cap

**9 - Refrigerant line with internal heat exchanger**

**10 - Front expansion valve**

**11 - Front evaporator**

- ☐ Evaporator in front heater and air conditioning unit (installed under dash panel)

**12 - Service connection, low-pressure side**

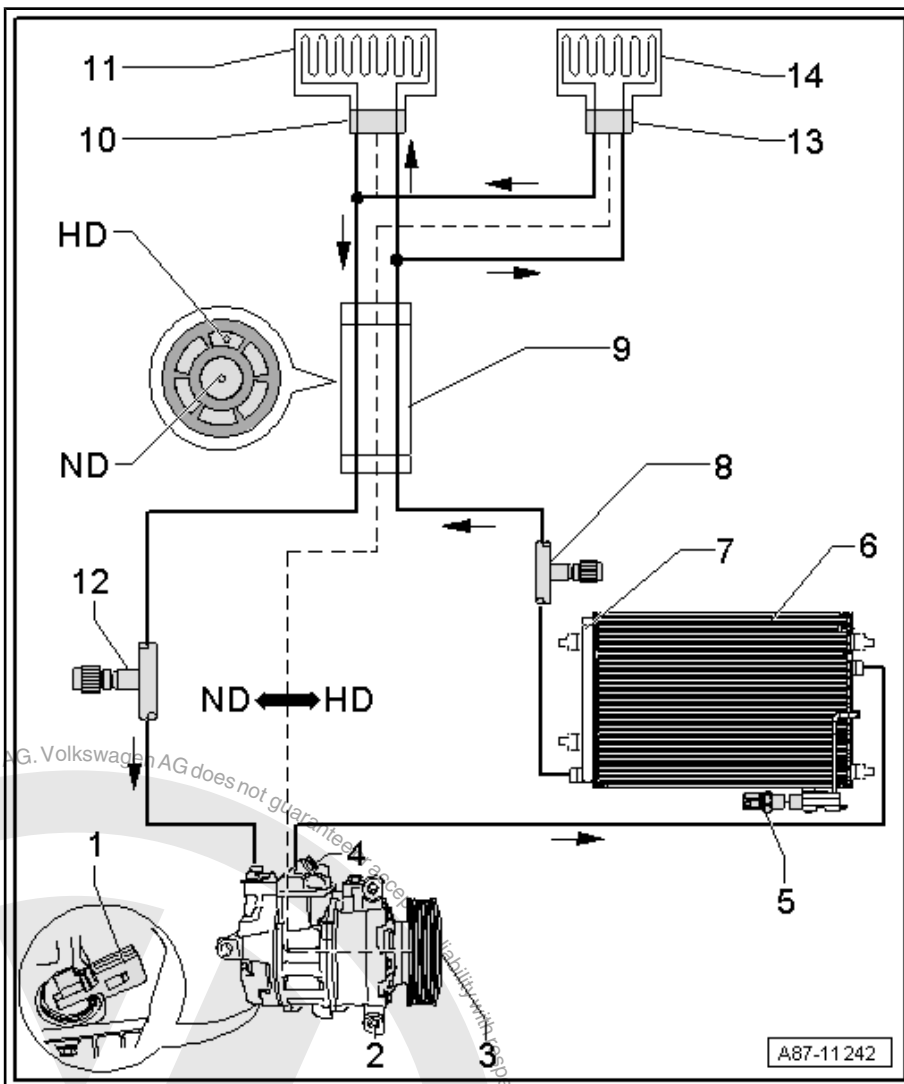
- ☐ With cap

**13 - Rear expansion valve**

- ☐ Only on vehicles with rear air conditioning unit (extra equipment)

**14 - Rear evaporator**

- ☐ Only on vehicles with rear air conditioning unit (extra equipment)





## 1.1.2 System overview - refrigerant circuit with restrictor and reservoir



### Note

- ♦ The arrows indicate the direction of coolant flow.
- ♦ The following diagram shows an example of a refrigerant circuit with one evaporator.
- ♦ This refrigerant circuit layout is currently not planned for VW/Audi vehicles.
- ♦ The layout of the refrigerant circuit is specific to the vehicle ⇒ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).

HD = High-pressure side

ND = Low-pressure side

1 - Air conditioner compressor regulating valve - N280-

2 - Air conditioner compressor

3 - Pulley

- ❑ Depending on the version, an air conditioning system magnetic clutch - N25- is installed in the belt pulley ⇒ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).
- ❑ Depending on the version there may be a drive unit instead of the belt pulley ⇒ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).

4 - High-pressure safety valve

5 - Condenser

6 - Refrigerant pressure sender

- ❑ Vehicle-specific versions ⇒ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual)

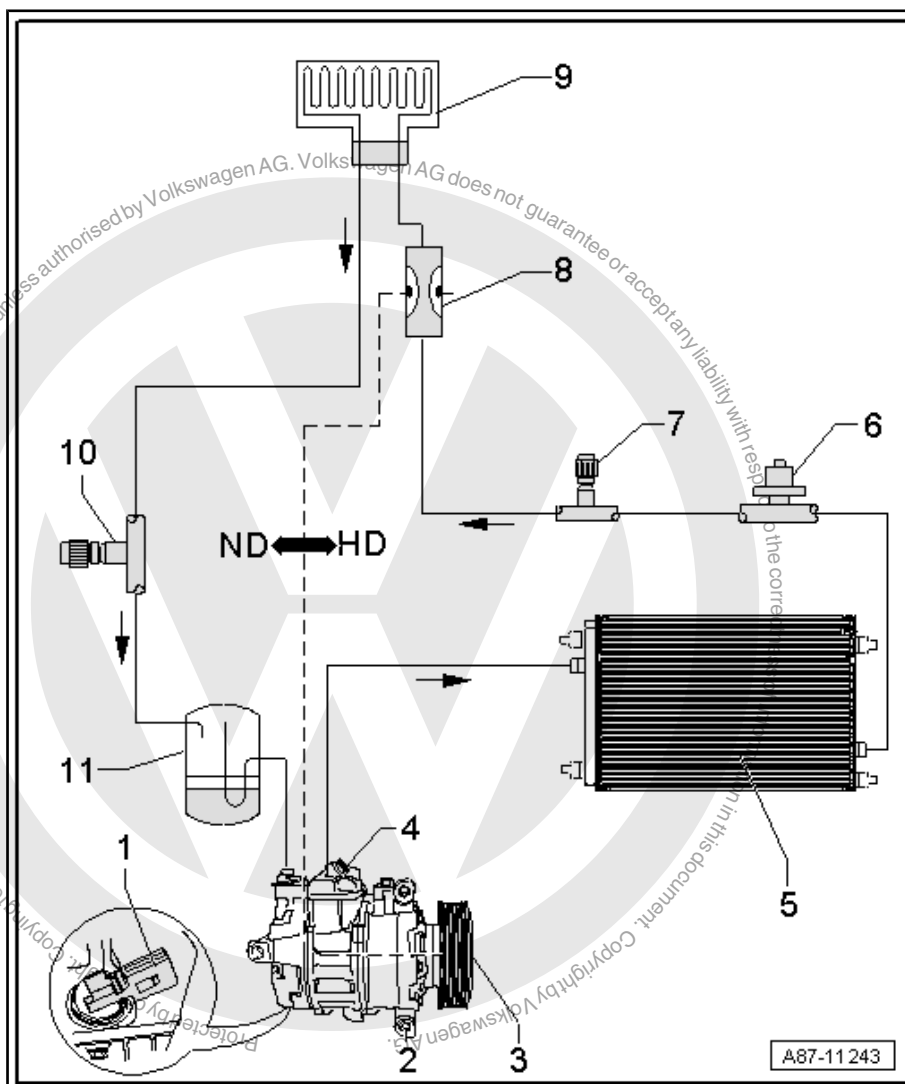
7 - Service connection, high-pressure side

- ❑ With cap

8 - Restrictor

9 - Evaporator

- ❑ Evaporator in front heater and air conditioning unit (installed under dash panel)





## 10 - Service connection, low-pressure side

- ☐ With cap

## 11 - Reservoir

- ☐ With desiccant cartridge

### 1.1.3 System overview - refrigerant circuit with electrically driven air conditioner compressor (with and without battery cooling module)



#### Note

- ◆ The arrows indicate the direction of coolant flow.
- ◆ The following diagram shows an example of a refrigerant circuit with expansion valve and second evaporator for battery cooling and one internal heat exchanger.
- ◆ The layout of the refrigerant circuit is specific to the vehicle. Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).

HD = High-pressure side

ND = Low-pressure side



## 1 - Electrical air conditioner compressor

- ☐ With control unit for air conditioner compressor - J842- and electrical air conditioner compressor - V470- ➔ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)

## 2 - High-pressure safety valve

## 3 - Condenser

- ☐ With receiver and desiccant cartridge

## 4 - Receiver

## 5 - Refrigerant pressure sender

- ☐ Vehicle-specific versions ➔ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)

## 6 - Service connection

- ☐ High-pressure side

## 7 - Refrigerant line

- ☐ With internal heat exchanger

## 8 - Refrigerant shut-off valve

- ☐ Different designations ➔ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)

- ☐ Only on vehicles with battery cooling module for hybrid battery unit - AX1-

## 9 - Expansion valve

- ☐ On evaporator in heater and air conditioning unit

## 10 - Evaporator

- ☐ In heater and air conditioning unit

## 11 - Expansion valve with shut-off valve-

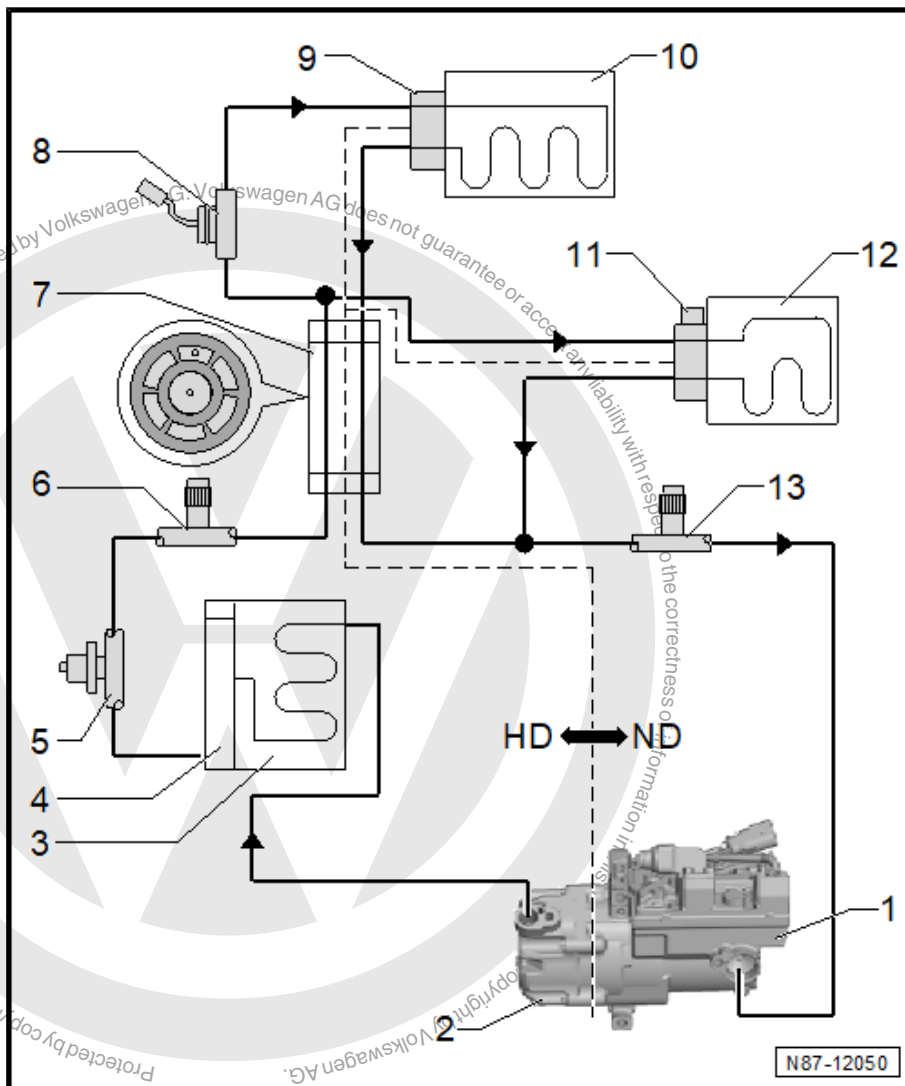
- ☐ Different designations ➔ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- ☐ On evaporator in battery cooling module
- ☐ Only on vehicles with battery cooling module for hybrid battery unit - AX1-

## 12 - Evaporator

- ☐ In battery cooling module
- ☐ Only on vehicles with battery cooling module for hybrid battery unit - AX1-

## 13 - Service connection

- ☐ Low-pressure side





## 1.2 General description - components of refrigerant circuit

- ⇒ [“1.2.1 Layout and function of refrigerant circuit”, page 35](#)
- ⇒ [“1.2.2 Mechanical air conditioner compressor”, page 37](#)
- ⇒ [“1.2.3 Electrical air conditioner compressor for hybrid vehicles”, page 39](#)
- ⇒ [“1.2.4 Condenser”, page 42](#)
- ⇒ [“1.2.5 Evaporator”, page 42](#)
- ⇒ [“1.2.6 Reservoir”, page 43](#)
- ⇒ [“1.2.7 Heat exchanger for heat pump mode”, page 44](#)
- ⇒ [“1.2.8 Liquid receiver”, page 44](#)
- ⇒ [“1.2.9 Restrictor”, page 45](#)
- ⇒ [“1.2.10 Receiver”, page 46](#)
- ⇒ [“1.2.11 Expansion valve \(with and without shut-off valve\)”, page 47](#)
- ⇒ [“1.2.12 Refrigerant shut-off valves”, page 49](#)
- ⇒ [“1.2.13 Refrigerant line with internal heat exchanger”, page 50](#)
- ⇒ [“1.2.14 Quick release couplings of refrigerant lines”, page 50](#)
- ⇒ [“1.2.15 Seals”, page 51](#)
- ⇒ [“1.2.16 Pipes and hoses in refrigerant circuit”, page 51](#)
- ⇒ [“1.2.17 High-pressure safety valve”, page 52](#)
- ⇒ [“1.2.18 Non-return valves”, page 53](#)
- ⇒ [“1.2.19 Quick-release coupling connections in refrigerant circuit”, page 54](#)
- ⇒ [“1.2.20 Connections with valve for switches in refrigerant circuit”, page 58](#)
- ⇒ [“1.2.21 Pressure senders and switches in refrigerant circuit”, page 58](#)
- ⇒ [“1.2.22 Refrigerant pressure and temperature sender”, page 59](#)
- ⇒ [“1.2.23 Air conditioner compressor regulating valve N280”, page 62](#)
- ⇒ [“1.2.24 Refrigerant temperature sender”, page 62](#)

### 1.2.1 Layout and function of refrigerant circuit

- ◆ Located on the high-pressure side are the condenser, receiver and restrictor or expansion valve to separate the high-pressure side (HD) and low-pressure side (ND).
- ◆ High pressure is created by the restrictor or expansion valve forming a constriction and causing the refrigerant to build up, thus leading to increased pressure and temperature.
- ◆ Excessive pressure results if the circuit is filled with too much refrigerant or refrigerant oil, or the condenser is dirty, the radiator fan is defective, there is a blockage in the system or there is moisture in the refrigerant circuit (causing the restrictor or expansion valve to ice up).



- ◆ Located on the low-pressure side are the evaporator, the temperature sensor for the evaporator and the air conditioner compressor that acts as the separation between the high-pressure (HD) and low-pressure (ND) gas sides.
- ◆ A loss of pressure in the system can be due to loss of refrigerant, restrictor or expansion valve defective or blocked, defective air conditioner compressor or an iced-up evaporator.







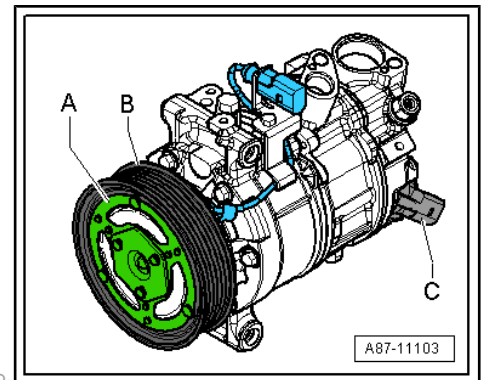
## 1.2.2 Mechanical air conditioner compressor

The air conditioner compressor is driven by a poly V-belt -B- or a shaft by the engine.

### Air conditioner compressor with air conditioning system magnetic clutch - N25- :

An electromagnetic clutch -A- attached to the air conditioner compressor provides power transfer between pulley -B- and compressor crankshaft when the air conditioning is switched on.

An overload protection device attached to the clutch plate or fitted in the solenoid of the air conditioner compressor triggers if there is resistance in the air conditioner compressor (sluggish movement), protecting the belt drive or the drive unit against overload.



#### Note

- ◆ To ensure that the air conditioner compressor is not damaged if the refrigerant circuit is empty, the air conditioner compressor regulating valve - N280- and, under certain circumstances, the air conditioning system magnetic clutch - N25- are no longer actuated (the air conditioner compressor only runs at idle with the engine if -N25- is actuated).
- ◆ An air conditioner compressor with -N25- (without -N280- ) is not actuated if the refrigerant circuit is empty and is therefore not driven.

### Air conditioner compressor without air conditioning system magnetic clutch - N25- :

- ◆ An overload protection device attached to the pulley -B- or fitted in the drive unit of the air conditioner compressor triggers if there is resistance in the air conditioner compressor (sluggish movement), protecting the belt drive or the drive unit against overload.
- ◆ An air conditioner compressor with air conditioner compressor regulating valve - N280- (without -N25- ) is switched over to internal lubrication via a valve if the refrigerant circuit is empty.



#### Note

- ◆ On air conditioner compressors without air conditioning system magnetic clutch - N25- , the engine may only be started following complete assembly of the refrigerant circuit.
- ◆ To ensure that the air conditioner compressor suffers no damage if the refrigerant circuit is empty, the air conditioner compressor regulating valve - N280- is no longer activated (the air conditioner compressor idles with the engine).

### All air conditioner compressors

The air conditioner compressor draws refrigerant gas from the evaporator, compresses it and sends it to the condenser.



## Note

- ◆ *The air conditioner compressor contains refrigerant oil, which can be mixed with R1234yf refrigerant at any temperature.*
- ◆ *The identification plate states the refrigerant for which the air conditioner compressor is suitable. A valve regulates the pressure on the low-pressure side within the specified range (control characteristic) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit .*
- ◆ *Depending on the version of air conditioner compressor, different refrigerant oils are filled in the air conditioner compressor. Refrigerant oils that were developed for R134a refrigerant oil only, must not be used for R1234yf refrigerant ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data; Refrigerant oil .*
- ◆ *Air conditioner compressors with or without air conditioning system magnetic clutch - N25- are currently actuated via an air conditioner compressor regulating valve - N280- -C- externally ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit .*
- ◆ *The identification plate states the refrigerant for which the air conditioner compressor is suitable. An air conditioner compressor regulating valve - N280- regulates the pressure on the low-pressure side within the specified range (control characteristic) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit .*
- ◆ *The air conditioner compressor regulating valve - N280- is actuated externally ⇒ Vehicle diagnostic tester in "Guided Fault Finding" in air conditioning system.*
- ◆ *The engine must not be started in a vehicle with air conditioner compressor but no air conditioner compressor magnetic clutch - N25- if there is negative pressure in the refrigerant circuit (e.g. during evacuation) ⇒ [page 123](#) .*
- ◆ *The engine may only be started in a vehicle with air conditioner compressor but no air conditioner compressor magnetic clutch - N25- when the refrigerant circuit has been completely assembled.*
- ◆ *To ensure that the air conditioner compressor suffers no damage if the refrigerant circuit is empty, the air conditioner compressor regulating valve - N280- is no longer activated (the air conditioner compressor idles with the engine) if the pressure in the refrigerant circuit is too low (lower than approx. 2 bar).*
- ◆ *An air conditioner compressor with air conditioner compressor regulating valve - N280- is switched over to internal lubrication via a valve if the refrigerant circuit is empty.*
- ◆ *Depending on the version of air conditioner compressor, a valve may be installed on the high-pressure side that prevents liquefied refrigerant flowing back into the air conditioner compressor after the air conditioning system is switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit with expansion valve, it could take some time before the pressure on the high-pressure side drops (the expansion valve is cold and the pressure on the low-pressure side rises quickly after switching off, the expansion valve closes and refrigerant only flows slowly on the low-pressure side). If the air conditioner compressor is switched on, the pressure on the low-pressure side drops, the expansion valve opens and refrigerant can flow on the low-pressure side.*



- ◆ *On an air conditioner compressor with electromagnetic clutch -A- and regulating valve -C-, the electromagnetic clutch -A- is usually only actuated if the regulating valve -C- is also actuated ⇒ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit .*

### 1.2.3 Electrical air conditioner compressor for hybrid vehicles

#### Vehicles with high-voltage system (hybrid vehicles)

If repair work in the vicinity of high-voltage components and cables is necessary, inspect high-voltage components and cables for damage ⇒ [page 4](#) ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .

If work on the components of the high-voltage system is necessary, ensure that the high-voltage system is de-energised ⇒ Rep. gr. 93 ; De-energising high-voltage system .

De-energise the high-voltage system and restarting the high-voltage system ⇒ Rep. gr. 93 ; De-energising high-voltage system

- To minimise the number of automatic engine starts when the vehicle's drive system is active (READY) during test and measurement work, charge the vehicle batteries e.g. with the battery charger 60 A - VAS 5904- in battery standby mode ⇒ Electrical system - General information; Rep. gr. 27 ; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .





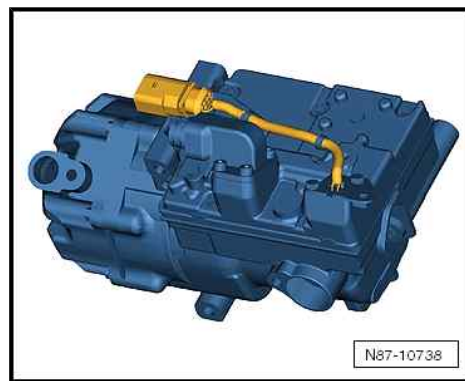
- For testing and measuring work that requires the vehicle's drive system to be active (READY) or the ignition to be switched on, move the selector lever to position "P", activate the parking brake, and arrange the tools needed so that they cannot come into contact with moving components of the engine and so that they cannot even come near to components that turn when the engine is running.

#### Electrical air conditioner compressor

##### NOTICE

**Risk of irreparable damage to electrical air conditioner compressor from short circuit.**

- **Never touch the air conditioner compressor when switching on the ignition or starting the drive machines.**
- ◆ The air conditioner compressor draws refrigerant gas from the evaporator, compresses it and sends it to the condenser.
- ◆ The electric motor of the air conditioner compressor is supplied with power e.g. from the power and control electronics for electric drive - JX1- ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ The control unit for air conditioner compressor - J842- integrated in the air conditioner compressor regulates the speed and thereby the performance of the air conditioner compressor ( electrical air conditioner compressor - V470- ) according to the request received via the data bus ➤ Vehicle diagnostic tester in "Guided Fault Finding" function of air conditioning system and battery control system
- ◆ There is no air conditioner compressor regulating valve - N280- in the electrical air conditioner compressor.
- ◆ The bolting points of the air conditioner compressor and the bracket must be checked prior to installation. The contact surfaces must be free of dirt, rust and grease. Otherwise, repair contact surfaces using contact surface cleaning set - VAS 6410- ⇒ Electrical system; General information; Rep. gr. 97 ; Wiring harness and connector repair .





## Note

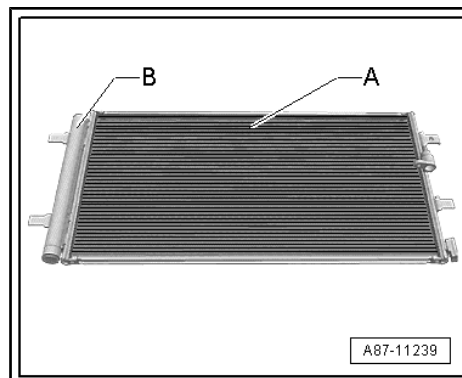
- ◆ *If the air conditioner compressor control unit - J842- is defective, the amount of refrigerant oil in the new air conditioner compressor must be adjusted. The refrigerant circuit must not be cleaned (flushed) with R1234yf.*
- ◆ *The control unit for air conditioner compressor - J842- and the electrical air conditioner compressor - V470- are one component and can currently not be separated.*
- ◆ *There is no -N280- installed in the electrical air conditioner compressor. The power of the air conditioner compressor is regulated externally by the speed of the air conditioner compressor ➔ Current flow diagrams, Electrical fault finding and Fitting locations and ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *The electrical air conditioner compressor currently works in the same way as a spiral or scroll-type charger (similar to a G-Lader).*
- ◆ *The air conditioner compressor contains refrigerant oil, which can be mixed with R1234yf refrigerant at any temperature.*
- ◆ *The identification plate states the refrigerant for which the air conditioner compressor is suitable.*
- ◆ *The integrated electronics regulate the performance of the air conditioner compressor via the speed (and thereby the pressure on the low-pressure side) within the specific target range (control characteristic).*
- ◆ *The engine should be started only when the refrigerant circuit has been fully assembled.*
- ◆ *The air conditioner compressor has an internal oil circuit to ensure that the air conditioner compressor is not damaged when the refrigerant circuit is empty. This means that approx. 40 to 50 cm<sup>3</sup> of refrigerant oil remain in the air conditioner compressor.*
- ◆ *Just like the mechanical air conditioner compressor, the electrical air conditioner compressor has a pressure relief valve.*
- ◆ *On vehicles with battery cooling, electric and hybrid operation is only possible with the air conditioning system charged and no faults stored in connection with the air conditioning system ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *First bring the electrical air conditioner compressor into operation after installing the air conditioner compressor and charging the refrigerant circuit via the "Compressor run-in" function in basic settings. Should there be an accumulation of refrigerant oil in the compression chamber of the air conditioner compressor before installation owing to unfavourable storage, damage could be caused to the air conditioner compressor ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *An electrically driven air conditioner compressor may only be activated when the refrigerant circuit is charged. Running the air conditioner compressor with the refrigerant circuit empty could lead to compressor damage ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode.*





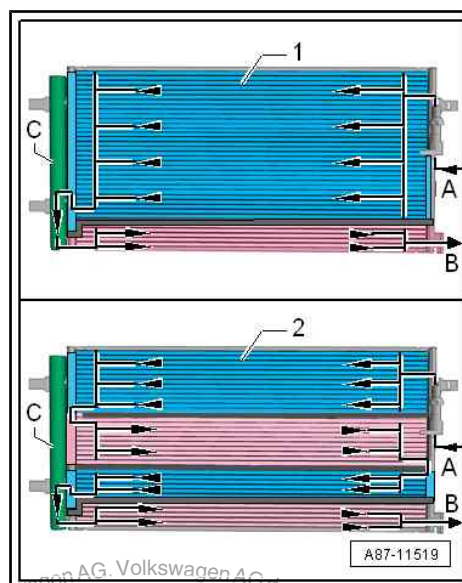
## 1.2.4 Condenser

- ◆ The condenser -A- transfers heat from the compressed refrigerant gas into the surrounding air.
- ◆ When this happens, the refrigerant gas condenses to liquid.



### Note

- ◆ Depending on the design of the refrigerant circuit, the receiver may be attached to the condenser or integrated in the condenser ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .
- ◆ There are different versions of the condenser; from the outside these versions can only be identified by their part number. Version -1- of the condenser is split into two sections ("two-pass condenser"). Version -2- of the condenser is split into four sections ("four-pass condenser").
- ◆ This illustration shows a condenser with the receiver -C- attached.
- ◆ The gaseous refrigerant enters the condenser at connection -A-; the refrigerant is then cooled down in the condenser and turns into liquid.
- ◆ The liquid refrigerant accumulates in receiver -C- (with dryer) and flows through the bottom cooling section to connection -B-.
- ◆ The refrigerant capacity in a refrigerant circuit may differ depending on the design of the condenser (internal volume, flow, etc.). Therefore, always ensure the version and allocation of the condenser are correct ⇒ Heating, air conditioning system; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .



## 1.2.5 Evaporator

There are different types of evaporator. Depending on the design and function, the thermal energy that is needed to evaporate the refrigerant is drawn from the air flowing through the system (e.g. with the evaporator in heater and air conditioning unit or in the battery cooling module) or the coolant flowing through the system (e.g. with the heat exchanger for the high-voltage battery) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



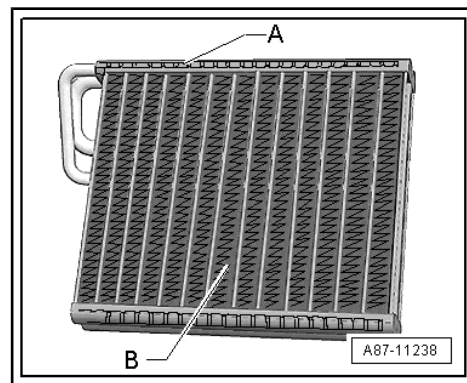
### Note

The following describes 2 versions of the evaporator.



### Evaporator in heating and air conditioning system (or in the battery cooling module)

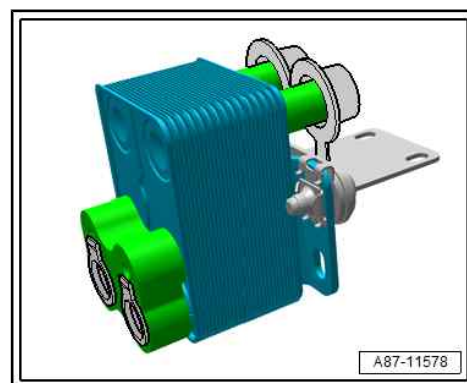
- ◆ The liquid refrigerant evaporates in the pipelines of the evaporator -A-. The heat required to do this is drawn from the air flowing over the evaporator fins -B-. The air cools down. The refrigerant evaporates and is drawn into the air conditioning system compressor carrying with it the heat it has absorbed.
- ◆ A defined quantity of refrigerant is fed to the evaporator through an expansion valve (restrictor). In systems with an expansion valve the flow rate is regulated such that only gaseous refrigerant emerges at the evaporator outlet.
- ◆ When R1234yf refrigerant was introduced, the evaporators were adapted to the refrigerant, hence the need to observe the correct version ➔ Electronic parts catalogue .



### Evaporator / heat exchanger for high-voltage battery (chiller)

The liquid refrigerant evaporates in the evaporator (heat exchanger). The heat required to do this is drawn from the coolant that flows through the evaporator. The coolant cools. The refrigerant evaporates and is drawn into the air conditioner compressor carrying with it the heat it has absorbed.

A defined quantity of refrigerant is fed to the evaporator through a restrictor (or an expansion valve) and a shut-off valve. The flow rate of the coolant (or refrigerant) is regulated in such a way that only gaseous refrigerant escapes at the evaporator outlet ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



## 1.2.6 Reservoir



### Note

*This type of air conditioning system is currently only installed in systems with a restrictor.*



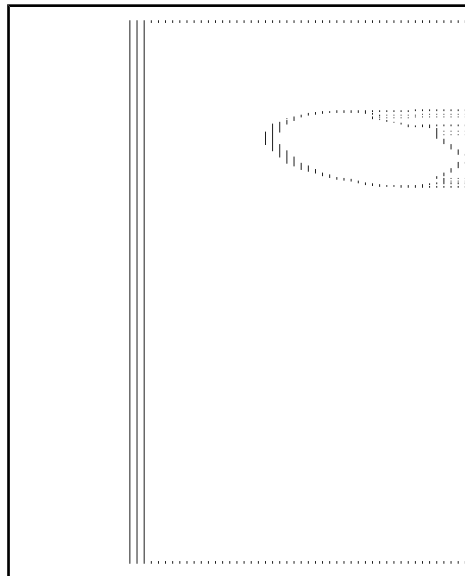


- ◆ The reservoir collects the vaporised and gaseous mixture coming from the evaporator to ensure the air conditioner compressor receives only gaseous refrigerant. The vapour becomes gaseous refrigerant.
- ◆ Refrigerant oil flowing in the circuit does not remain in the reservoir because an oil extraction hole has been provided.
- ◆ Any moisture ingress into the refrigerant circuit during assembly is trapped by a filter (desiccant bag) in the reservoir.
- ◆ Gaseous refrigerant with oil is drawn in by the air conditioner compressor.



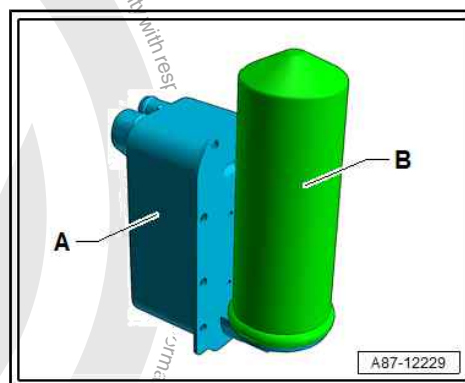
#### Note

- ◆ *Renew the reservoir if the refrigerant circuit has been open for an extended period of time and moisture has entered or if required to do so owing to a specific complaint ⇒ [page 78](#) .*
- ◆ *Do not remove sealing plugs -A- and -B- until just before installation.*
- ◆ *A dryer kept in an unsealed reservoir is saturated with moisture after a short time and cannot be used.*
- ◆ *When installing, observe arrow indicating direction of flow if applicable.*



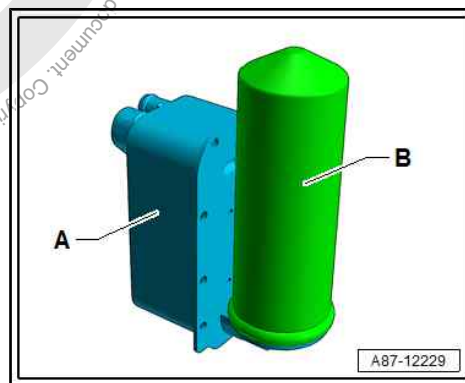
### 1.2.7 Heat exchanger for heat pump mode

The gaseous or vaporous refrigerant compressed by the air conditioning compressor is liquefied in the heat exchanger -A-. The heat that is given off in the process is picked-up by the coolant flowing through the system ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .



### 1.2.8 Liquid receiver

In certain operating conditions (e.g. in heat pump mode), the receiver (e.g. on the condenser) is not integrated in the refrigerant circuit. The receiver -B- collects the refrigerant, temporarily stores any excess should a certain amount of refrigerant not be required and then feeds it in a steady flow to the expansion valve (in front of the evaporator in the heater and air conditioning unit) or to the heat exchanger in the coolant circuit of the high voltage system ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .





## 1.2.9 Restrictor

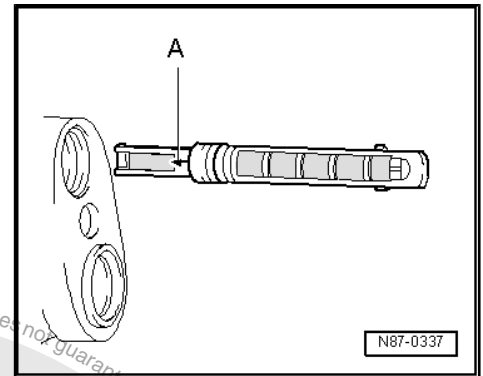
### Restrictor in front of evaporator



#### Note

*Currently, there is no air conditioning system with a restrictor installed in front of the evaporator.*

- ◆ The restrictor creates a constriction. This restriction limits the flow, separating the high pressure and low pressure sides in the refrigerant circuit. Upstream of the restrictor, the refrigerant is warm due to the high pressure. Downstream of the restrictor, the refrigerant is cold due to the low pressure. Upstream of the constriction is a strainer to catch dirt and downstream of the constriction is a strainer to atomise the refrigerant before it enters the evaporator.



#### Note

- ◆ Arrow -A- on the restrictor points to the evaporator.
- ◆ Renew every time the refrigerant circuit is opened.
- ◆ Note different versions; refer to the various customer service information ➔ Electronic parts catalogue .

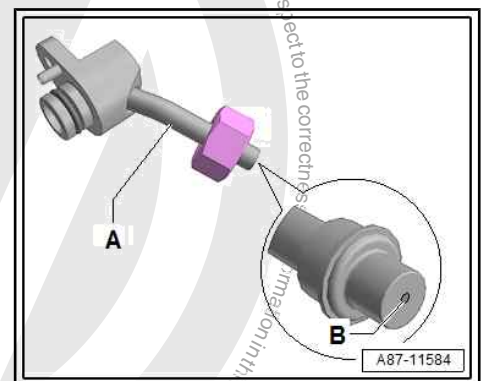
### Restrictor in front of heat exchanger for high-voltage battery (chiller)

The restrictor creates a constriction. This restriction limits the flow, separating the high pressure and low pressure sides in the refrigerant circuit. Upstream of the restrictor, the refrigerant is warm due to the high pressure. Downstream of the restrictor, the refrigerant is cold due to the low pressure.



#### Note

- ◆ The illustration shows a refrigerant line -A- with a permanently installed restrictor -B- (without strainer).
- ◆ The diameter of the shown restrictor hole -B- is approx. 0.7 mm. Depending on the refrigerant line version, this restrictor is permanently installed or it can be removed. For the removable version a strainer may be fitted to prevent the restrictor hole from being blocked by suspended particles.
- ◆ Check for soiling before installing and clean or renew as necessary.
- ◆ Observe different versions.





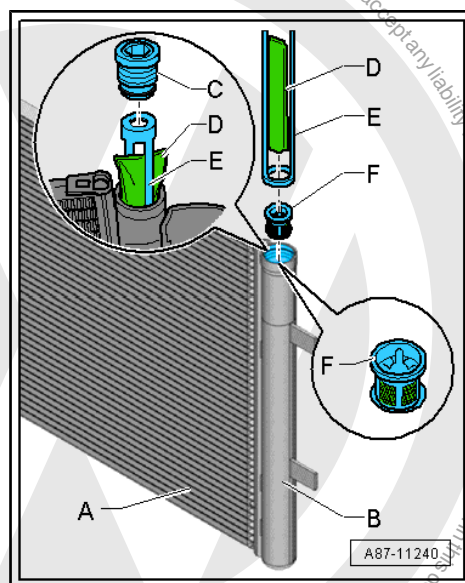
### 1.2.10 Receiver

- ◆ The receiver -B- collects the liquid droplets and directs them in a continuous stream to the expansion valve. Any moisture that has entered the refrigerant circuit during assembly is collected by a dryer -D- in the receiver -B-.
- ◆ Depending on the layout of the refrigerant circuit and the version of condenser -A-, the receiver -B- may be installed on the condenser -A- or (integrated) in the condenser -A- ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ➤ Electronic parts catalogue .
- ◆ Installed in the receiver -B- is a dryer (e.g. desiccant bag -D-) and strainer -F- (that filters out smaller contaminants).



#### Note

- ◆ *The receiver -B- comes in different versions and different designs ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ➤ Electronic parts catalogue .*
- ◆ *Renew the receiver -B- and plastic bolt (with seals) -C-, desiccant cartridge -D-, filter carrier -E- and strainer -F- if the refrigerant circuit was open for an extended period of time and moisture has been absorbed, or if required to do so owing to a specific complaint ➤ [page 78](#) .*
- ◆ *Do not remove the sealing plugs of a receiver until immediately prior to installation as a desiccant bag in a non-sealed reservoir will become saturated with moisture and become unusable.*
- ◆ *The desiccant cartridge comes in an air-tight transport bag, which should remain sealed for as long as possible. Do not open the transport bag until immediately prior to inserting the desiccant cartridge -D- in the receiver -B- of the condenser. After the transport bag has been opened, the desiccant cartridge will become saturated with moisture within a short time and is then unusable.*
- ◆ *When installing, observe arrow indicating direction of flow if applicable.*
- ◆ *The procedure to adopt in the event of a complaint differs depending on the type of receiver/desiccant cartridge. If the receiver is installed on the condenser, for example, it can be renewed completely with the desiccant cartridge. If the receiver is integrated in the condenser, for example, the desiccant cartridge and an additional filter element (if one is fitted) can be replaced individually on most versions. If the receiver is integrated in the condenser and it is not possible to replace the receiver/desiccant cartridge separately, it may be necessary to replace the entire condenser ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ➤ Electronic parts catalogue .*
- ◆ *Depending on the layout of the refrigerant circuit (with desiccant bag or desiccant cartridge), the receiver may also be integrated in the refrigerant circuit (it need not always be installed on or in the condenser) ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ➤ Electronic parts catalogue .*





## 1.2.11 Expansion valve (with and without shut-off valve)

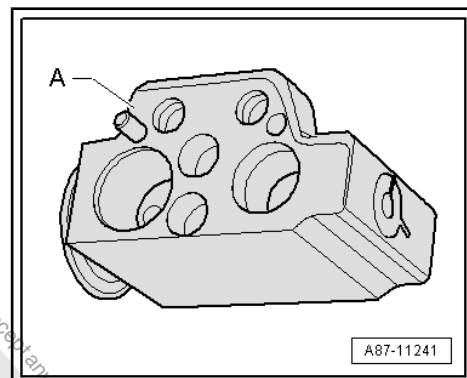
### Expansion valve without shut-off function

The expansion valve -A- atomises incoming refrigerant and regulates the flow so that, depending on the heat transport, the vapour does not become a gas until it reaches the outlet of the evaporator.



#### Note

- ◆ When R1234yf refrigerant was introduced, the expansion valves were adapted to the refrigerant (different characteristics), hence the need to observe the correct version ⇒ *Electronic parts catalogue*.
- ◆ Different versions of expansion valve due to different characteristics that are matched to the relevant refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ *Electronic parts catalogue*.
- ◆ When renewing the expansion valve, make sure that the part number is correct ⇒ *Electronic parts catalogue*.
- ◆ Depending on the version of air conditioner compressor, a valve may be installed on the high-pressure side that prevents liquefied refrigerant flowing back into the air conditioner compressor after the air conditioning system is switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit with expansion valve, it could take some time before the pressure on the high-pressure side drops (the expansion valve is cold and the pressure on the low-pressure side rises quickly after switching off, the expansion valve closes and refrigerant only flows slowly on the low-pressure side). If the air conditioner compressor is switched on, the pressure on the low-pressure side drops, the expansion valve opens and refrigerant can flow on the low-pressure side.



### Expansion valve with refrigerant shut-off valve

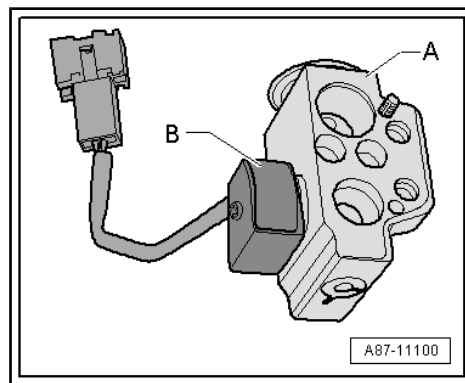


#### Note

Shut-off valves come in different versions, with different functions and different designations ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).



- ◆ The expansion valve -A- with shut-off valve -B- atomises the incoming refrigerant and regulates the flow rate of the refrigerant to the evaporator in the battery cooling module of the hybrid battery unit - AX1- in such a way that, depending on the heat transport, the vapour does not become a gas until it reaches the outlet of the evaporator.
- ◆ If the shut-off valve -B- is actuated by the electronics, it is open and allows refrigerant to flow through to the expansion valve -A-.
- ◆ If the shut-off valve -B- is open, the expansion valve -A- allows refrigerant to flow through to the evaporator or heat exchanger based on its control characteristic ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .
- ◆ The solenoid -B- attached to the expansion valve -A- is actuated by different control units depending on the vehicle ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ If, on a vehicle with 2 evaporators (one in the heater and air conditioner unit and one in the battery cooling module, e.g. the Audi Q5 Hybrid), the temperature measured at one evaporator meets the specification or falls below the specification, while on the other evaporator however the requisite specification is not reached, regulation works as follows: the battery regulation control unit - J840- makes the electrical air conditioner compressor run at a higher speed via the power and control electronics for electric drive - JX1- and the control unit for air conditioning compressor - J842- (which results in the cooling output of the air conditioning system rising and pressure on the low pressure side falling along with the evaporator temperature). If, as a result, the temperature at one evaporator falls below the specified level, -J840- actuates refrigerant shut-off valve 1 for hybrid battery - N516- or refrigerant shut-off valve 2 for hybrid battery - N517- in such a way that the evaporator - which is too cold - no longer has refrigerant flowing through it ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

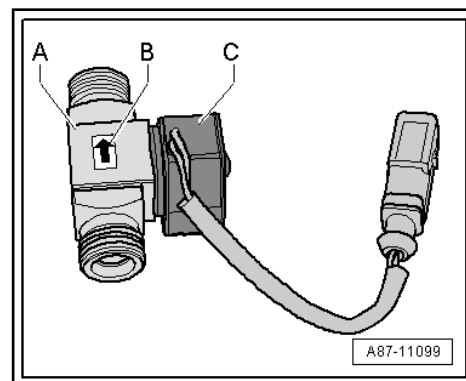




## 1.2.12 Refrigerant shut-off valves

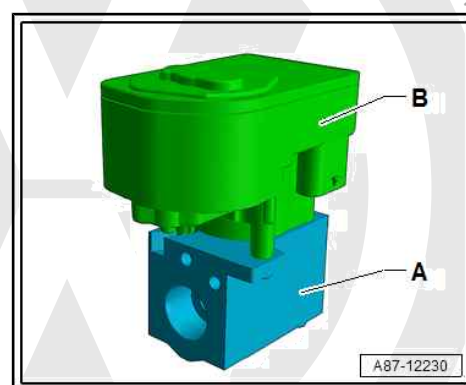
### Shut-off valves with 2 switch statuses (open or closed)

- ◆ Shut-off valves come in different versions, with different functions and different designations ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .
- ◆ If the shut-off valve -A- is not actuated by the electronics, it is open and allows refrigerant to flow through.
- ◆ The shut-off valve -A- is installed on vehicles with high-voltage system, for example. It is actuated when no climate control is wanted for the passenger compartment but battery cooling is required for the hybrid battery unit - AX1- .
- ◆ Note the arrow -B- on the shut-off valve -A-, which shows the direction of refrigerant flow (from condenser to evaporator in the heater and air conditioning unit).
- ◆ The solenoid -C- attached to the shut-off valve -A- is actuated by different control units depending on the vehicle ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- ◆ If, on a vehicle with 2 evaporators (one in the heater and air conditioner unit and one in the battery cooling module, e.g. the Audi Q5 Hybrid), the temperature measured at one evaporator meets the specification or falls below the specification, while on the other evaporator however the requisite specification is not reached, regulation works as follows: the respective control unit makes the electrical air conditioner compressor run at a higher speed (which results in the cooling output of the air conditioning system rising and pressure on the low pressure side falling along with the evaporator temperature). If the temperature at an evaporator then falls below the specified level, the respective control unit actuates the shut-off valve in such a way that the evaporator that is too cold no longer has refrigerant flowing through it ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.



### Shut-off valves regulated via characteristic curves

- ◆ The shut-off valve -A- is actuated via an incremental motor -B- by the respective control unit with characteristic curves (open or closed).
- ◆ If the shut-off valve acts as a control valve (e.g. refrigerant expansion valve 1 - N636- as is the case with the Audi Q7), it is only opened enough to allow the temperature set for the heat exchanger to be reached ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .
- ◆ Shut-off valves actuated via incremental motors do not have a defined rest position. For this reason, they have to be set to a certain position (open or closed) before work on the refrigerant circuit is performed ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .
- ◆ Depending on layout of the refrigerant circuit there could be a cluster of shut-off valves forming a valve block (e.g. on the e-Golf or Audi Q7 e-tron) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .
- ◆ The incremental motor is programmed and actuated via data lines (LIN-Bus) by the respective control unit in relation to its installation location ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.







### 1.2.13 Refrigerant line with internal heat exchanger

- ◆ In this refrigerant line, the warm liquid refrigerant flowing on the high pressure side supplies energy to the cold refrigerant gas or vapour flowing on the low pressure side, thus enhancing the efficiency of the air conditioner.



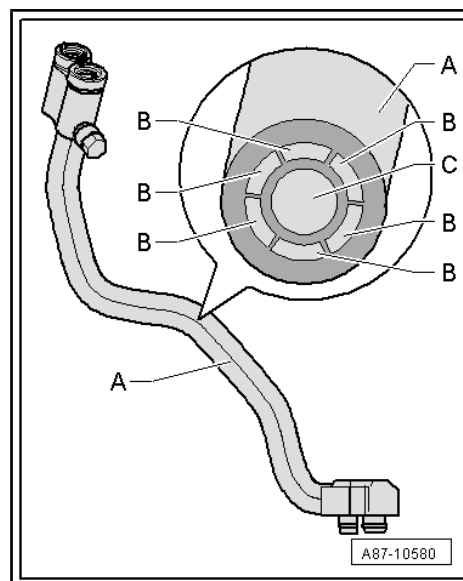
#### Note

*This illustration shows a refrigerant line with inner heat exchanger as fitted e.g. on the Golf 7, Audi A4 2008 > and Audi A5 Coupé 2008 > ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .*

A - Refrigerant line with internal heat exchanger

B - Channels in the refrigerant line along which hot liquid refrigerant flows to the evaporator (high pressure side of refrigerant circuit).

C - Channel in the refrigerant line through which the cold gaseous or vaporous refrigerant flows to the air conditioner compressor (low pressure side of refrigerant circuit).



### 1.2.14 Quick release couplings of refrigerant lines

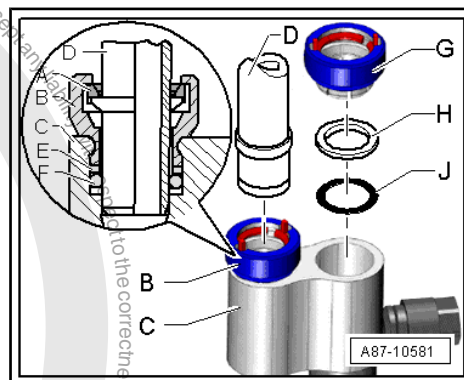


#### Note

- ◆ *This illustration shows the quick-release couplings with a refrigerant line with internal heat exchanger as fitted e.g. on the Audi A4 2008 > and the Audi A5 Coupé 2008 > ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

- ◆ *Removal of the refrigerant line -D- involves opening the retaining ring -A- e.g. with the refrigerant line release tool ( release tool - T40149- or removal tool - T40232- ) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

- ◆ *After removing the respective refrigerant line, the quick release couplings -B- and -G- are to be renewed along with the associated support ring -E- or -H- and the associated seal -F- or -J- ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*



A - Retaining ring (in quick release coupling on high pressure side)

B - Quick release coupling with retaining ring "high pressure side"

C - Refrigerant line with internal heat exchanger

D - Refrigerant line "high pressure side"

E - Support ring "high pressure side"

F - Seal "high pressure side"

G - Quick release coupling with retaining ring "low pressure side"

H - Support ring "low pressure side"

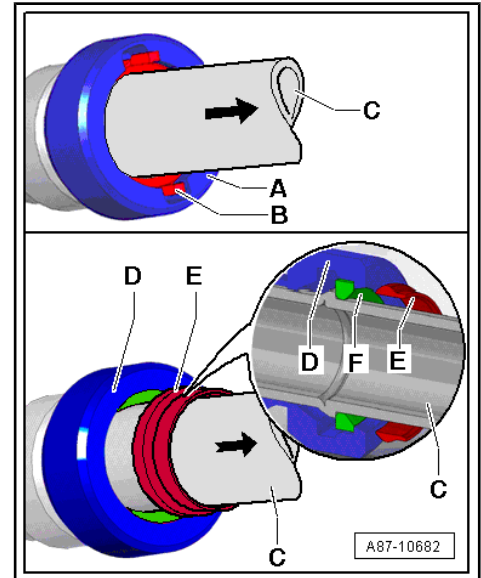
J - Seal "low pressure side"





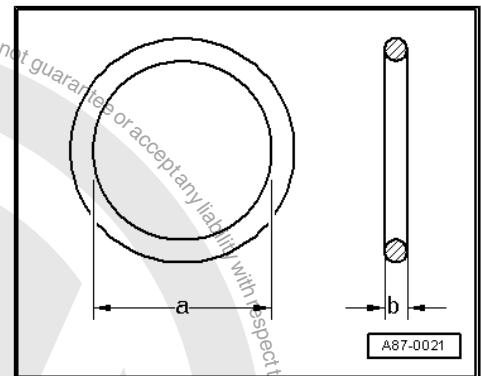
#### Note

- ◆ The quick release couplings come in different versions -A- and -D-. On both versions of these quick release couplings, the refrigerant lines -C- can be released and removed in the same way, e.g. with refrigerant line release tool -T40149/1- ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ For quick release coupling version -A-, the control pins -B- become visible after installing the refrigerant line -C- once the engaged refrigerant line -C- is pulled in the direction of arrow.
- ◆ For quick release coupling version -D-, the refrigerant line -C- is installed in the same way as quick release coupling -A-. When the refrigerant line -C- on this version is pulled in the direction of arrow following assembly, the snap ring -E- protrudes from the quick release coupling -D-, thereby indicating that the retaining ring -F- is completely engaged with the refrigerant line -C-. The snap ring -E- must then be removed from the refrigerant line -C-.



### 1.2.15 Seals

- ◆ These seals seal the connection points between the individual components of the refrigerant circuit  
⇒ ["3.2 Refrigerant circuit seals" page 8](#).



### 1.2.16 Pipes and hoses in refrigerant circuit

- ◆ In its pure state, R1234yf refrigerant is chemically stable and has no corrosive effect on e.g. iron, aluminium and specially developed plastics that are suitable for this purpose. A mixture of refrigerant oil and R1234yf refrigerant can affect certain metals (e.g. alloys with copper) and affect or degrade certain hose materials and plastics. Therefore, use only genuine replacement parts ➔ Electronic parts catalogue .
- ◆ Only use components that are resistant to R1234yf refrigerant and its associated refrigerant oils. Do not use components (such as seals and hoses, which are made of plastic) that cannot be clearly allocated ➔ Electronic parts catalogue .
- ◆ The pipes and hoses are held together by threaded connections and / or special joints ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Renew the sealing elements (e.g. seals) between the components ➔ Electronic parts catalogue .
- ◆ For threaded connections, observe the specified torque settings. For pressure-fit connections, use dedicated release tools ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

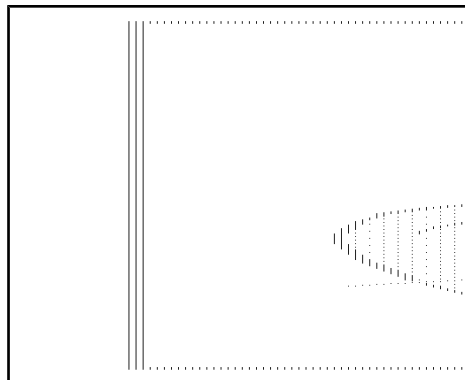


## 1.2.17 High-pressure safety valve

The high pressure safety valve is fitted to the air conditioner compressor or the receiver.

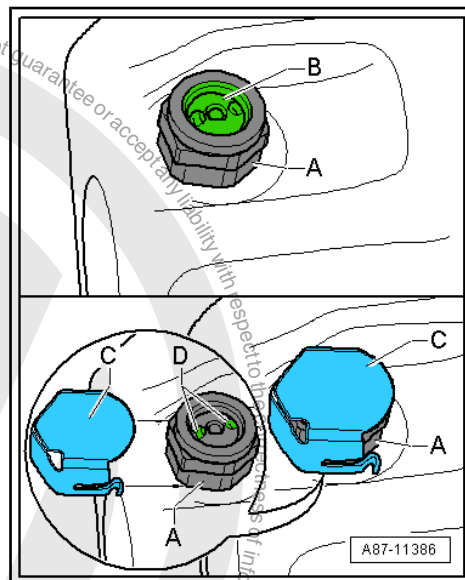
The valve opens at a pressure of approx. 38 bar (overpressure) and closes again when the pressure has dropped (to approx. 35 bar).

Not all the refrigerant is lost from the system.



### Note

- ◆ Depending on the version, a transparent plastic washer -B- may be attached to the high pressure safety valve -A- which breaks off as soon as the valve is actuated.
- ◆ Depending on the version of high pressure safety valve -A-, a cover -C- may also be pushed onto the high pressure safety valve -A-. Should the pressure in the refrigerant circuit actually rise above the opening pressure of the high pressure safety valve -A- and cause the valve to open, refrigerant will not escape in one direction but scatter through the openings -D- beneath the cover -C- instead.
- ◆ If a high-pressure safety valve -A- needs to be renewed, the specified torque for the new valve (depending on the manufacturer and the version of the air conditioner compressor) must be observed when installing. Air conditioner compressors manufactured by "Denso", "Sanden" and "Valeo" are equipped with an O-ring (currently valid torque settings are: 10 Nm for "Denso" and "Zexel/Valeo" air conditioner compressors, and 15 Nm for "Sanden" air conditioner compressors). Air conditioner compressors manufactured by "Delphi" are fitted with an oil seal (currently valid torque setting: 15 Nm).
- ◆ Renewing seals (oil seals or O-rings) ⇒ Electronic parts catalogue .
- ◆ If a seal (oil seal or O-ring) fitted to the high-pressure safety valve is not available as a replacement part, the removed old part can be reused (as an exception to the general rule of using new seals only). The old seal, however, must always be checked for damage prior to installation. If any damage or deformation is detected on the old seal, it must be renewed with a commercially available new part ⇒ Electronic parts catalogue .
- ◆ After filling the refrigerant circuit, check the installed high-pressure safety valve for leaks using e.g. an electronic leak detector.





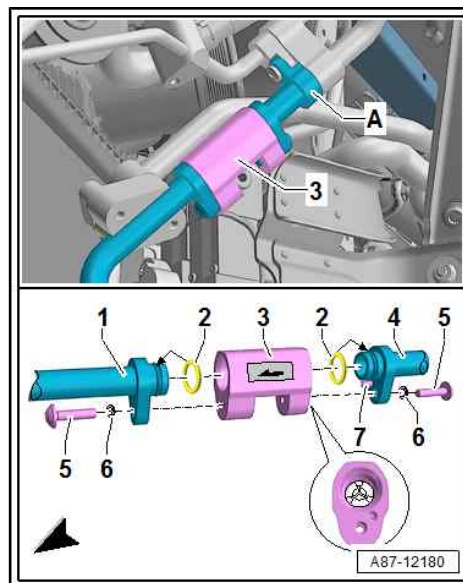
## 1.2.18 Non-return valves

Non-return valves separate the refrigerant circuit into different areas ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).



### Note

- ◆ The non-return valve -3- shown in installed e.g. in the Audi Q7 e-tron ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Non-return valves in the refrigerant circuit have a certain holding pressure in the direction of flow (approx. 0.1 bar or 100 mbar). To ensure that the refrigerant circuit can be evacuated completely (residual pressure below 5 mbar), all of the electrically actuated valves must therefore be open.
- ◆ Depending on the version, the direction of flow may be indicated by a sticker.





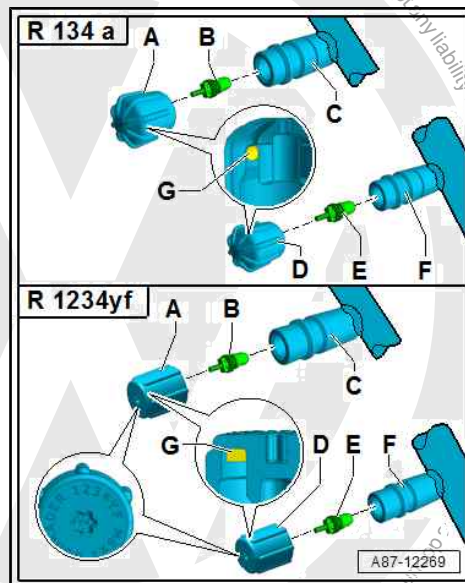
## 1.2.19 Quick-release coupling connections in refrigerant circuit

### Service connections with Schrader valve (needle valve or push pin)

- ◆ Only valves and connections resistant to R1234yf refrigerant and the related refrigerant oils may be used.
- ◆ Service connections -C- and -F- in an R1234yf refrigerant circuit are configured in such a way that service couplings cannot be connected to service connections designed for an R134a refrigerant circuit.
- ◆ Different connections (external diameter) for high pressure and low pressure sides -F- and -C-.
- ◆ Before removing the valves or valve inserts -B- and -E-, empty the refrigerant circuit.
- ◆ Always screw on sealing caps -A- and -D- with seal -G-.

Layout in vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

- Extract refrigerant before unscrewing the valves.
- ◆ Service connection, low-pressure side -C-
- ◆ Service connection, high-pressure side -F-
- ◆ Valve insert (designation: Schrader or needle valve)
- ◆ Sealing cap for service connection on low pressure side with seal -A-
- ◆ Sealing cap for service connection on high pressure side with seal -D-





#### Note

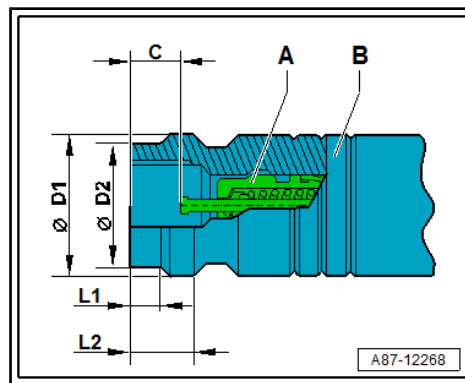
- ◆ *Carefully, and no more than necessary, screw in the hand-wheel of the service coupling (after connecting) into the quick release coupling adapter until the valve in the service connection is open (observe pressure gauge; do not over-tighten valve).*
- ◆ *Service connections in an R1234yf refrigerant circuit are configured in such a way that service couplings cannot be connected to service connections designed for an R134a refrigerant circuit.*
- ◆ *The service connections are brazed into e.g. a refrigerant line and therefore cannot be replaced individually.*
- ◆ *When removing and installing valve core with refrigerant circuit discharged, use a socket - T10364- or similar.*
- ◆ *Exercise caution when tightening the valve insert due to the low tightening torque.*
- ◆ *There are different versions of these valves; therefore tightening torques vary. For a valve insert -C- with a VG5 thread (5.2 x 0.7 mm, tyre valve) the tightening torque is 0.4 Nm  $\pm$  0.1 Nm; for a valve insert with an M6 x 0.75 mm thread the tightening torque is 0.9 Nm  $\pm$  0.1 Nm, and for a valve insert with an M8 x 1.0 mm thread the tightening torque is 2.0 Nm  $\pm$  0.2 Nm.*
- ◆ *These valve caps come in different versions, which means that the specified torques will differ. For a valve cap with an M8 x 1 mm or M10 x 1 mm thread, the specified torque is 0.4 Nm  $\pm$  0.1 Nm respectively.*
- ◆ *These valves, valve inserts and corresponding sealing caps come in different versions. Make sure that the correct type of valve insert is used and allocation of the sealing caps is correct  
⇒ Electronic parts catalogue .*

#### Dimensions of service connections



- ◆ Valve insert -A- (different versions).
- ◆ Service connection -B- (different versions on high pressure and low pressure side depending on refrigerant)

Dimensions of service connections -B-	Service connection for R134a refrigerant		Service connection for R1234yf refrigerant	
	High-pressure side	Low-pressure side	High-pressure side	Low-pressure side
External diameter -D1-	16.0 mm	13.0 mm	17.0 mm	14.0 mm
External diameter -D2-	14.0 mm	11.0 mm	13.0 mm	12.0 mm
Shoulder -L1-	4.6 mm	6.15 mm	9.0 mm	4.75 mm
Shoulder -L2-	8.16 mm	9.16 mm	12.5 mm	7.2 mm
Installation position of valve (unactuated) -C-	6.1 - 7.1 mm	6.1 - 7.1 mm	8.3 - 9.3 mm	8.3 - 9.3 mm



#### Service connections with primary sealing valve (ball valve)

- ◆ This type of service connection is currently not used in VW/Audi refrigerant circuits.
- ◆ Only valves and connections resistant to R1234yf refrigerant and the related refrigerant oils may be used.
- ◆ Service connections in an R1234yf refrigerant circuit are configured in such a way that service couplings cannot be connected to service connections designed for an R134a refrigerant circuit.
- ◆ Different connections (external diameter) for high-pressure and low-pressure sides.
- ◆ Discharge refrigerant circuit before removing valve or valve inserts.
- ◆ Always screw on sealing caps with seal.

Layout in vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).





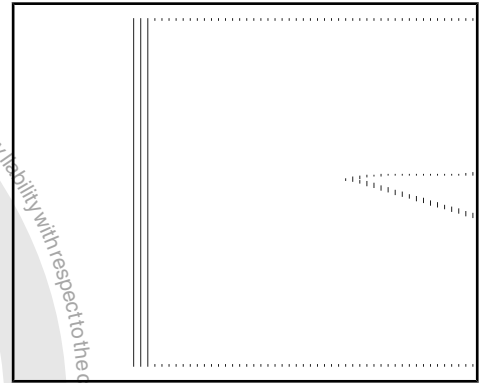
### Connection with high pressure valve

- 1 - Boss with internal thread (brazed on)
- 2 - Seal (version and designation: black or coloured ⇒ Electronic parts catalogue )
- 3 - Valve with external thread and groove for seal (designation: ball valve)
- 4 - Cap seal
- 5 - Sealing cap



#### Note

- ◆ *Carefully, and no more than necessary, screw in the hand-wheel of the service coupling (after connecting) into the quick release coupling adapter until the valve in the service connection is open (observe pressure gauge; do not over-tighten valve).*
- ◆ *When removing and installing the valve -3- with purged refrigerant circuit, use e.g. an adapter from socket set - T10364- .*
- ◆ *These valves come in different versions (with internal or external thread) and the specified torques can therefore differ. For the valves -3- currently in use (external thread M12 x 1.5 mm) the tightening torque is 9 Nm ± 1 Nm.*
- ◆ *These valves and corresponding sealing caps come in different versions. Make sure that the correct type of valve is used and allocation of the sealing caps is correct ⇒ Electronic parts catalogue .*



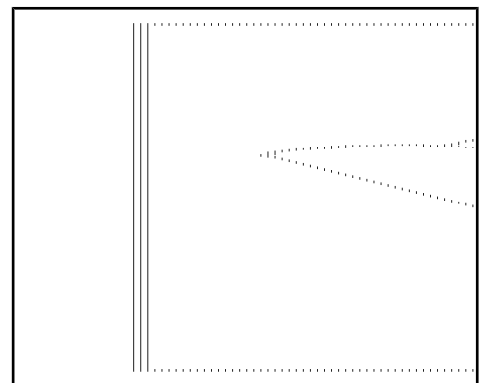
### Connection with low pressure valve

- 1 - Boss with external thread and groove for O-ring (brazed in)
- 2 - Seal (version and designation: black or coloured ⇒ Electronic parts catalogue )
- 3 - Valve with internal thread
- 4 - Cap seal
- 5 - Sealing cap



#### Note

- ◆ *Carefully, and no more than necessary, screw in the hand-wheel of the service coupling into the quick release coupling adapter until the valve in the service connection is open (observe pressure gauge; do not over-tighten valve).*
- ◆ *When removing and installing the valve -3- with purged refrigerant circuit, use e.g. an adapter from socket set - T10364- .*
- ◆ *These valves come in different versions (with internal or external thread) and the specified torques can therefore differ. For the valves -3- currently in use (internal thread M10 x 1.25 mm) the tightening torque is 9 Nm ± 1 Nm.*
- ◆ *These valves and corresponding sealing caps come in different versions. Make sure that the correct type of valve is used and allocation of the sealing caps is correct ⇒ Electronic parts catalogue .*





## 1.2.20 Connections with valve for switches in refrigerant circuit



### Note

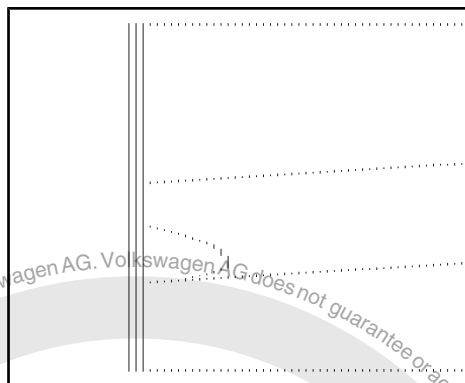
Refer to vehicle-specific refrigerant circuit for switching pressures, removing and installing switches and location/design of switches ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

- The switches on the high pressure and low pressure sides have different threads.
- Only valves and seals resistant to R1234yf refrigerant and the related refrigerant oils may be used ⇒ Electronic parts catalogue .

A - Connection (brazed)

B - Seal

C - Valve (with seal)



### Note

- ♦ To remove and install the valve -C- with the refrigerant circuit empty, use e.g. an adapter from socket set - T10364- (specified torque ⇒ [page 54](#) ).
- ♦ There are different versions of these valves; therefore tightening torques vary. For a valve insert -C- with a VG5 thread (5.2 x 0.7 mm, tyre valve) the tightening torque is 0.4 Nm ± 0.1 Nm; for a valve insert with an M6 x 0.75 mm thread the tightening torque is 0.9 Nm ± 0.1 Nm, and for a valve insert with an M8 x 1.0 mm thread the tightening torque is 2.0 Nm ± 0.2 Nm.

## 1.2.21 Pressure senders and switches in refrigerant circuit



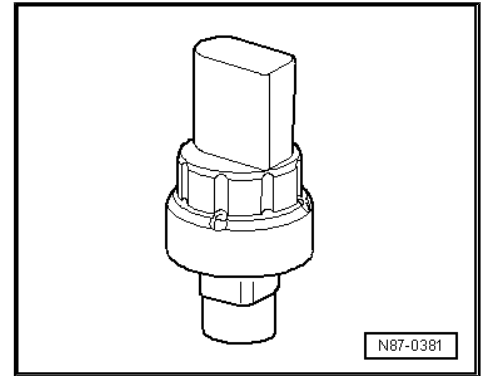
### Note

- ♦ Pressure senders and switches come in different versions, with different functions and different designations ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ♦ Switching pressures, removing and installing switches and switch layout and type ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).





- ◆ The high pressure sender shown is installed e.g. in the Golf 7 and Audi A3 ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One version of pressure sender generates a square-wave signal when voltage is applied. This signal changes with the pressure in the system. The other version of pressure sender exchanges information with the corresponding control unit via data bus (e.g. via the "LIN bus") when voltage is applied ➤ Current flow diagrams, Electrical fault finding and Fitting locations and ➤ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system. Therefore, pay attention to the correct version of pressure sender.
- ◆ The pressure senders come in different versions. Depending on the version, they can currently only be distinguished externally by the part number, which is why attention should be paid during renewal to their correct allocation (part number ➤ Electronic parts catalogue ). Reason: These senders emit different signals, and the relevant control units can only evaluate the signal to which they have been matched ➤ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One version of pressure sender only transmits the measured value for the pressure in the refrigerant circuit to the connected control unit. The other version transmits the measured value for the pressure in the refrigerant circuit and the measured temperature to the connected control unit, which is why attention should be paid to the correct version ➤ Electronic parts catalogue .
- ◆ With this signal, the downstream control units calculate the pressure in the refrigerant circuit and actuate the radiator fans and engine, the air conditioning system magnetic clutch - N25- accordingly or manipulate actuation of the air conditioner compressor regulating valve - N280- ➤ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).



### 1.2.22 Refrigerant pressure and temperature sender

#### CAUTION

**Risk of freezing injury caused by escaping pressurised refrigerant.**

**There is a risk of injury to the skin and parts of the body due to freezing.**

- Wear protective gloves.
- Wear protective goggles.
- Extract refrigerant and open the refrigerant circuit immediately afterwards.
- If more than 10 minutes have passed since the refrigerant was extracted, repeat the extraction process before opening the refrigerant circuit. Pressure could build up in the refrigerant circuit from continued evaporation.

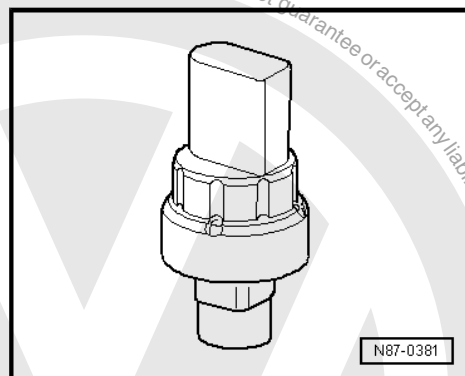


## Senders for connection to a refrigerant circuit with valve



### Note

- ◆ Refer to vehicle-specific refrigerant circuit for switching pressures, removing and installing switches and location/design of switches ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ These senders come in different versions, with different functions and different designations. The refrigerant pressure and temperature sender - G395- shown as follows is installed e.g. in the Golf GTE, Audi A4, Audi Q5 and Audi Q5 Hybrid ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- ◆ Before loosening the threaded connection of the sender, check which version of sender it is ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- ◆ For senders designed for connection to a refrigerant circuit without valve. The refrigerant must be extracted before the threaded connection is loosened. If the sender is not removed within 10 minutes after the system has been evacuated, pressure may develop in the refrigerant circuit due to re-evaporation. Extract refrigerant again.
- ◆ Different designations depending on the function and vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- ◆ The sender for refrigerant pressure and refrigerant temperature is installed e.g. in place of the high pressure sender or pressure sender for refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- ◆ The sender for refrigerant pressure and refrigerant temperature, the pressure sender for refrigerant circuit and high pressure sender come in different versions. Depending on the version, they can currently only be distinguished externally by the part number, which is why attention should be paid during renewal to their correct allocation (part number ⇒ Electronic parts catalogue ). Reason: These senders emit different signals, and the relevant control units can only evaluate the signal to which they have been matched ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The sender for refrigerant pressure and refrigerant temperature (and the pressure sender for refrigerant circuit) exchange information with the respective control unit via the data bus (e.g. "LIN bus") when voltage is applied. The respective control units use this information to calculate the pressure and temperature in the refrigerant circuit. Any faults detected in this way are passed on to the control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ The sender for refrigerant pressure and refrigerant temperature transmits the measured value for the pressure in the refrigerant circuit and the measured temperature to the connected control unit. The pressure sender for refrigerant circuit only transmits the measured value for the pressure in the refrigerant circuit to the connected control unit. Even though on most vehicles only the pressure signal is evaluated, no other pressure sender may be installed in a vehicle for which provision is made for a refrigerant pressure and refrigerant temperature sender ⇒ Electronic parts catalogue .





- ◆ The temperature measured by this refrigerant pressure and temperature sender deviates from the actual temperature of the refrigerant in the refrigerant circuit owing to the design of the sender and the fitting location. It is therefore not evaluated at present by all control units and is used to regulate the air conditioning system ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- ◆ With this information, the respective control units calculate the pressure in the refrigerant circuit and actuate the downstream control units (radiator fan control unit, engine control unit etc.) via data bus. These control units subsequently actuate e.g. the air conditioning system magnetic clutch - N25- , the radiator fan and the engine ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

#### **Senders for connection to a refrigerant circuit without valve**



#### **Note**

- ◆ *These senders come in different versions, with different functions and different designations. The sender for refrigerant pressure and refrigerant temperature shown as follows is installed e.g. in the Audi Q7 e-tron ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .*
- ◆ *Different designations depending on the function and vehicle ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .*

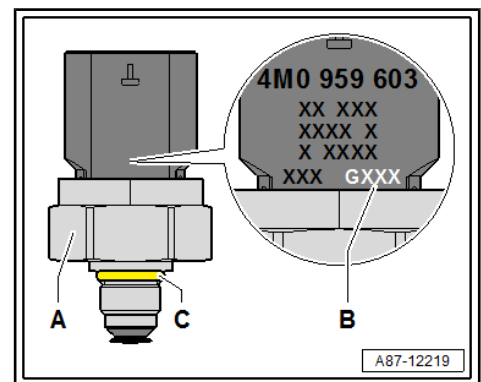
#### **Possible designations for these senders**

- ◆ Refrigerant pressure and temperature sender - G395- (e.g. in e-Golf, Audi Q7 e-tron)
- ◆ Refrigerant pressure and temperature sender 2 - G826- (e.g. in Audi Q7 e-tron)
- ◆ Refrigerant pressure and temperature sender 3 - G827- (e.g. in Audi Q7 e-tron)

These senders -A- come in different versions that, depending on the version, can currently only be distinguished externally by the part number or, if the part number is the same, by the designation label -B-, which is why when renewing them it is important to ensure the correct allocation. Part number and designation ⇒ Electronic parts catalogue and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - Refrigerant circuit .

When a voltage is applied, these senders exchange information with the respective control unit via the data bus (e.g. via "LIN bus"). The respective control units use this information to calculate the pressure and temperature in the refrigerant circuit. Any faults detected in this way are passed on to the control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

With this information, the respective control unit calculates the pressure in the refrigerant circuit and actuates the downstream control units or components (radiator fan control unit, pumps, valves etc.) via data bus according to the specifications ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).





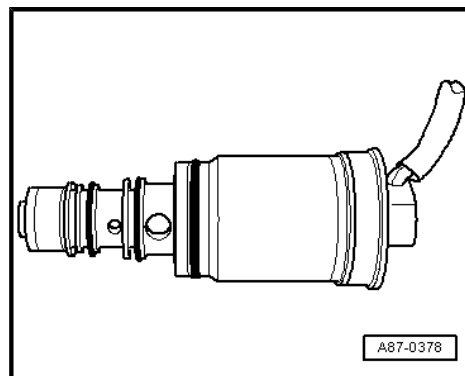
### 1.2.23 Air conditioner compressor regulating valve - N280-



#### Note

*Refer to vehicle-specific refrigerant circuit for switching pressures, removing and installing switches and location/design of switches ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .*

- ◆ The regulating valve is fitted to the air conditioner compressor. It is actuated, for example, by the air conditioning system control unit - J301- , the operating and display unit for front air conditioning system - E87- or the Climatronic control unit - J255- (potentially also via data bus and an additional control unit depending on the vehicle) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The regulating valve influences the pressure on the low pressure side and thus the temperature at the evaporator.



#### Note

*The air conditioner compressor regulating valve - N280- is an integral part of the air conditioner compressor and cannot be renewed individually on all air conditioner compressors ⇒ Electronic parts catalogue .*

### 12.24 Refrigerant temperature sender



#### Note

- ◆ A refrigerant temperature sender (a temperature sender that does not evaluate the pressures) is currently not used by Volkswagen/Audi.
- ◆ Switching pressures, removing and installing switches and switch layout and design ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

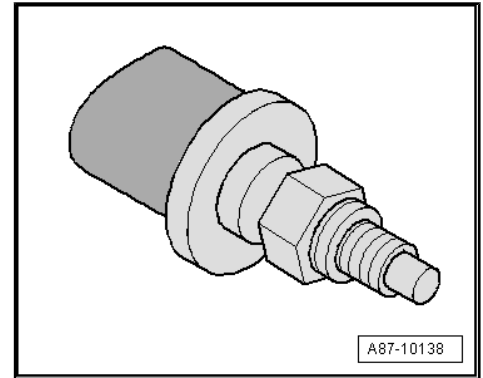


- ◆ The refrigerant temperature sender (with temperature-dependent resistor) is installed e.g. in the high pressure line in the vicinity of the air conditioner compressor.
- ◆ There is a direct correlation between temperature and pressure in the refrigerant circuit: if there is too little refrigerant in the refrigerant circuit, the temperature in the refrigerant circuit rises during operation of the air conditioning system on the high pressure side greater than permitted for this pressure.



#### Note

*The respective control unit, e.g. the operating and display unit for front air conditioning system - E87- or the Climatronic control unit - J255- evaluates the pressure and the temperature in the refrigerant circuit and switches off the air conditioner compressor if the temperature increases above the value stored for this pressure  
⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*



## 1.3 Possible complaints

⇒ ["1.3.1 Prerequisites for investigating a complaint", page 63](#)

⇒ ["1.3.2 Possible complaints", page 63](#)

⇒ ["1.3.3 Odours from heater and air conditioner unit", page 65](#)

### 1.3.1 Prerequisites for investigating a complaint

- No fault was evident during fault finding in the electrical system, vacuum system and air ducts/channels ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system (and battery control), ⇒ Current flow diagrams, Electrical fault finding and Fitting locations and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output .
- Self-diagnosis in "Guided Fault Finding" mode - air conditioning system (e.g. using ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system) provides no evidence of a complaint.
- No shut-off condition for the air conditioner compressor is displayed in the measured values of the control unit of the air conditioning system ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.

### 1.3.2 Possible complaints



#### Note

- ◆ *For all complaints marked with \**  
⇒ ["2.14 Checking pressures", page 164](#) .
- ◆ *If on vehicles with 2 evaporators a problem is encountered in just one evaporator, check the pressures in the refrigerant circuit as well ⇒ "2.14 Checking pressures", page 164* .
- ◆ The cooling has failed completely.\*
- ◆ Insufficient cooling output at all vehicle speeds and engine speeds.\*
- ◆ No or insufficient cooling after driving a few miles. \*



- ◆ No cooling or insufficient cooling from one or two evaporators (on vehicles with 2nd heater and air conditioner/evaporators).  
\*
- ◆ Actuation of the air conditioner compressor (via the air conditioning system magnetic clutch - N25- or the air conditioner compressor regulating valve - N280- ) is switched off by the respective control unit (e.g. the operating and display unit for front air conditioning system - E87- , the air conditioning system control unit - J301- or the Climatronic control unit - J255- ) due to pressure in the refrigerant circuit being too high or too low \* ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
- ◆ The electrical air conditioner compressor - V470- is not actuated by the control unit for air conditioning compressor - J842- due to pressure being too high or too low \* ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- ◆ If fresh air supply is lacking or drops significantly after a few miles (evaporator iced up) \* ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.

**In addition, the following problems may occur:**

The air conditioner compressor is noisy.

- Re-tighten the securing bolts for the air conditioner compressor and the air conditioner compressor bracket using a torque wrench ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Check the routing of the refrigerant lines. These must not rest against other components and must not be under any strain (realign them if necessary) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .

Noises (refrigerant hammering) occur immediately after the air conditioning is switched on and/or in a curve or when the brakes are applied:

- Drain the refrigerant circuit, evacuate it and recharge (too much refrigerant or refrigerant oil in the circuit) ⇒ [page 123](#) and ⇒ ["2.14 Checking pressures", page 164](#) .



**Note**

*Excess refrigerant oil in the circuit may also cause this problem (e.g. if the refrigerant oil level was not checked after the air conditioner compressor was renewed) ⇒ [page 78](#) .*

Water sprays out of the vents (in dash panel or footwell) although air conditioning system is otherwise functioning properly:

- Check condensation drain to ensure that it is routed correctly. It should not be kinked or crushed ⇒ Heating, air conditioning; Rep. gr. 87 ; Front heater and air conditioner .
- The condensed water drain valve must not be hindered in its operation by wax or underbody sealant and must open and close properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Front heater and air conditioner .
- Check plenum chamber cover. It must not be damaged and must be installed correctly (no water should run into the evaporator) ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system; Overview of fitting locations - components outside passenger compartment .





- Check water drainage points of plenum chamber. These should not be blocked (e.g. by leaves) ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system; Overview of fitting locations - components outside passenger compartment .



#### Note

*Installation location and other information about these components ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .*

### 1.3.3 Odours from heater and air conditioner unit

⇒ [page 65](#)

⇒ [page 66](#)

⇒ [page 66](#)

#### Does the odour emanate from the evaporator or heat exchanger?

##### ◆ Fishy smell

- Due to leak in engine's cooling system or in heat exchanger of heater and air conditioner unit.



#### Note

*If the fishy smell is weaker when the temperature is set too "cold" or stronger when the temperature is set to "warm", check the heat exchanger for leaks.*

##### ◆ Smell of a burnt clutch

##### ◆ Vapours from foot mats, retrospectively installed seat covers etc.

##### ◆ Putrid, mouldy smell

- Caused by accumulation of debris, pine needles etc. in plenum chamber



#### Note

*Clean the plenum chamber.*

- Stagnant water that cannot flow out of plenum chamber.



#### Note

*Check the water drainage points in the plenum chamber.*

##### ◆ Smell from heater and air conditioner unit



#### Note

*Smells that originate from the heater and air conditioner unit can be detected in fresh air mode and in recirculation mode.*



- Due to too much condensate in the heater and air conditioner unit



**Note**

*Check the condensation drain.*

- Due to an old or very dirty dust and pollen filter



**Note**

*Check the dust and pollen filter.*

- Due to deposits on the fins of the evaporator



**Note**

*Clean the evaporator with the ultrasonic air conditioner cleaning unit ➔ [page 66](#) or suction feed spray-gun and corresponding spray lance ➔ [page 66](#) .*

**Ultrasonic air conditioner cleaning unit**

- The ultrasonic air conditioner cleaning unit must be placed in the front-passenger footwell and sprays the agent Aero-Clean. Aero-Clean neutralises microbes and bacteria in the heater and air conditioner unit.

The device is provided with instructions for use.

Current equipment ➔ Electronic parts catalogue .

**Spraying the evaporator with the suction feed spray-gun and spray lance**

Directly spray the evaporator with cleaning solution using a spray lance (approx. 10 bar). The cleaning solution neutralises microbes and bacteria directly on the evaporator.

To enable access to the evaporator, preparatory measures and different spray lances are required.

Vehicle-specific operating instructions are provided with the evaporator cleaning solution ➔ Electronic parts catalogue .





## 1.4 Investigating leaks

⇒ [“1.4.1 General information about investigating leaks in the refrigerant circuit”, page 67](#)

⇒ [“1.4.2 Searching for leaks in refrigerant circuits using an electronic leak detector”, page 68](#)

⇒ [“1.4.3 Searching for leaks with UV leak detection system”, page 70](#)

⇒ [“1.4.4 Detecting leaks in a vacuum test using air conditioner service station , or in a pressure test”, page 76](#)

⇒ [“1.4.5 Detecting leaks in a pressure test \(with nitrogen or compressed air\)”, page 76](#)

### 1.4.1 General information about investigating leaks in the refrigerant circuit



#### Note

- ◆ *Small leaks can be detected with e.g. an electronic leak detector or a UV leak detector lamp.*
- ◆ *This workshop manual describes 2 ways of tracing leaks in refrigerant circuits. These procedures have been tested and lead to a reliable result under the different usage conditions if they are performed correctly and in accordance with the specific complaint.*
- ◆ *Various methods are offered in the open market with which leaks in refrigerant circuits can be traced. These methods are not able to provide clear results in all cases and, unless the exact procedure is adhered to, they can also result in various components of the refrigerant circuit being identified as having leaks even though they do not. Furthermore, certain processes can cause preliminary or permanent damage to the components of the refrigerant circuit*
- ◆ Components that are found to be leaking must not be repaired. They must be renewed instead.
- ◆ A leaking refrigerant circuit must not be charged with refrigerant. Therefore, evacuate an empty refrigerant circuit and check for leaks before charging the system with refrigerant  
⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) .



#### Note

- ♦ *VW/Volkswagen/Audi does not endorse the use of chemical substances (leak inhibitor additives) for purposes of sealing leaks in refrigerant circuits.*
- ♦ *Chemical substances used to seal leaks form deposits in the refrigerant circuit. These can impair the function of the air conditioning system and cause the air conditioning system (and your air conditioner service station ) to fail.*
- ♦ *These chemical substances (leak stop additives) react mostly with the ambient air or the humidity to stop leaks in the refrigerant circuit. They cause deposits to build up in the refrigerant circuit (and your air conditioner service station ), cause valves to malfunction and defects in other components with which they come into contact. These deposits cannot be completely removed from the components (not even by cleaning/flushing). The refrigerant circuit can only be repaired by replacing all components that have come into contact with this substance.*

## 1.4.2 Searching for leaks in refrigerant circuits using an electronic leak detector

### Special tools and workshop equipment required

- ♦ Electronic leak detector or proprietary device



#### Note

- ♦ *Leaks in R1234yf refrigerant circuits can only be found using electronic leak detection devices designed for R1234yf refrigerant.*
- ♦ *The various refrigerants have a different molecular structure. The sensors of electronic leak detection devices are adapted to these molecules. If an electronic leak detection device is used that is not designed for R1234yf refrigerant, it will not respond to R1234yf refrigerant at all or only in larger concentrations in the vicinity of the leak. For this reason, electronic leak detection devices designed only for R134a refrigerant cannot be used for leak detection in the R1234yf refrigerant circuit.*
- ♦ *Depending on the type of heater and air conditioner unit, a leak from the evaporator can be investigated by holding the test probe of the leak detector against the glove compartment cooler connection in the heater and air conditioner unit, or by holding the test probe against the open condensation drain connection of the heater and air conditioner unit with the condensation drain hose pulled off.*

### Performing leak detection on a completely empty refrigerant circuit caused by a leak:



#### Note

*With a completely empty refrigerant circuit, proceed as follows to ensure that no more refrigerant than necessary enters the environment during testing:*

- Evacuate refrigerant circuit using air conditioner service station ⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) .



#### Note

- ◆ *If a larger leak is detected during the evacuation process, determine the cause and rectify as described  
⇒ ["2.5 Evacuating refrigerant circuit", page 134](#) .*
- ◆ *If during the evacuation process no leak is detected or a very small leak is detected that cannot be located using the vacuum test, proceed as follows.*
- If the refrigerant circuit is completely empty, charge the system with approx. 10% of refrigerant and perform leak detection in the same way as per a fully charged refrigerant circuit  
⇒ [page 69](#) .

#### Performing leak detection on a charged refrigerant circuit:

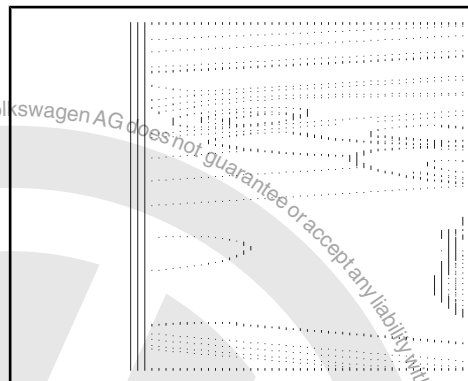
- Switch off ignition.
- Start the leak detector according to the operating instructions.
- Always hold probe tip under location of suspected leak.

If, inherent of the design, the rate of clicks rises or a wailing noise is heard, a leak has been detected ⇒ operating instructions for leak detector .



#### Note

- ◆ *Refrigerant gas is quickly dispersed by movement of air. Draughts must therefore be avoided during leak detection.*
- ◆ *Refrigerant gas is heavier than air and therefore sinks at the point at which it escapes.*





### 1.4.3 Searching for leaks with UV leak detection system



#### Note

- ◆ *Certain leaks are difficult or impossible to find using an electronic leak detection device. To investigate these leaks, leak detection can be performed using the leak detection system  
⇒ Electronic parts catalogue .*
- ◆ *Refrigerant and refrigerant oil leaks out of the refrigerant circuit when the circuit has a leak. This oil generally remains in the vicinity of the leak location. To make the oil visible under UV light, a small amount of fluorescent fluid must be added to the refrigerant circuit. This fluid (PAG oil with an additive which lights up under UV light) is injected into the refrigerant circuit and distributed with the refrigerant oil when the air conditioning system is switched on.*
- ◆ *The air conditioning system must be operated for at least 60 minutes to ensure that the injected leak detecting additive is distributed throughout the entire refrigerant circuit (air conditioner compressor must run). The leak may become visible under UV light after a short period, but this depends on the size of the leak.*
- ◆ *The refrigerant oil with additive, which lights up under UV light, can be added directly in an open circuit or charged after emptying the circuit with air conditioner service station via the service connection.*
- ◆ *If the leak detection additive is added to the refrigerant circuit via the service connection, a small amount of leak detection additive will be deposited in the service connection. Carefully remove any deposits so that this area is not mistaken for a leak during subsequent leak detection.*
- ◆ *If a component from a circuit in which leak detection additive is filled is renewed, thoroughly clean the connection points to other components after assembling the refrigerant circuit. During subsequent leak detection, deposits of leak detection additive could otherwise be mistaken for leaks at the connecting point.*
- ◆ *When purging the refrigerant circuit, refrigerant oil and therefore also leak detection additive also enter the air conditioner service station . The refrigerant oil is separated from the refrigerant in the oil separator of the air conditioner service station and removed from the air conditioner service station via the drainage outlet. The drained refrigerant oil may not be reused. It must be replaced with fresh refrigerant oil.*
- ◆ *If leak detection fluid was injected during a previous repair of the refrigerant circuit, observe the following: do not inject new leak detection fluid unless the refrigerant machine oil has been replaced. If only some of the refrigerant machine oil was replaced then only the respective amount of leak detection fluid should be injected. If, for example, 100 ml of refrigerant oil is replaced in a vehicle with 250 ml of refrigerant oil, inject only 1 ml (cm<sup>3</sup>) of leak detection additive.*
- ◆ *Certain materials and their compounds (e.g. oxidation products on components made from aluminium, corrosion protection wax, etc.) also light up under UV light.*



- ◆ Depending on the type of air conditioner service station, it can also be used to add the leak detection additive directly into the system. See the operating instructions of your air conditioner service station ⇒ [Operating instructions air conditioner service station](#).

#### Leak detection on an empty, leaking refrigerant circuit

- With a completely empty refrigerant circuit, proceed as follows to ensure that no more refrigerant than necessary enters the environment during testing:
- Evacuate refrigerant circuit with air conditioner service station ⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#).



#### Note

If a larger leak is detected during the evacuation process, determine the cause and rectify as described

⇒ [“1.4.4 Detecting leaks in a vacuum test using air conditioner service station, or in a pressure test”, page 76](#) and  
⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#).

If during the evacuation process no leak is detected or a very small leak is detected that cannot be located during evacuation, proceed as follows.



#### Note

- ◆ Only use UV leak detection additive approved for R1234yf refrigerant.
- ◆ The leak detection additive contains refrigerant oil for the most part. Since special refrigerant oils are required for R1234yf refrigerant, only UV leak detection additives may be used that use this oil as a carrier. UV leak detection additives developed for R134a refrigerant are therefore unsuitable.
- ◆ For refrigerant circuits with R1234yf and R134a refrigerant, different refrigerant oils (PAG oils) are used, which is why it is important to ensure correct allocation of the leak detection additive (PAG oil with an additive that lights up under UV light).
- ◆ Charge the refrigerant circuit with UV leak detection additive using the air conditioner service station ⇒ [page 74](#).
- ◆ Charge the refrigerant circuit with UV leak detection additive using the leak detection system ⇒ [page 74](#).
- Charge the refrigerant circuit with the specified amount of UV leak detection additive and the requisite amount of refrigerant ⇒ [page 71](#), ⇒ [“2.6 Charging refrigerant circuit”, page 140](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data.
- Run the air conditioning system for at least 60 minutes with the air conditioner compressor switched on.
- Investigate leaks with UV leak detection system ⇒ [page 74](#).

#### Charge the refrigerant circuit with UV leak detection additive using the air conditioner service station.

- Charge the refrigerant circuit with UV leak detection additive and the requisite amount of refrigerant using air conditioner service station ⇒ [“2.6 Charging refrigerant circuit”, page 140](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data.



## Note

- ◆ The amount of UV leak detection additive to be charged in the refrigerant circuit with a refrigerant oil volume up to  $150 \text{ cm}^3$  is  $3.0 \pm 0.5 \text{ ml}$ . If the volume of refrigerant oil in the refrigerant circuit is greater, more UV leak detection additive must be added accordingly, e.g.  $5.0 \pm 0.5 \text{ ml}$  in a refrigerant circuit with a refrigerant oil volume of  $250 \text{ cm}^3$ . If the UV leak detection additive is filled with an air conditioner service station, the volume to be set in your air conditioner service station may differ. Therefore, observe the relevant operating instructions  $\Rightarrow$  Operating instructions Air conditioner service station.
- ◆ For the specific volume of refrigerant oil in the refrigerant circuit, refer to the vehicle-specific workshop manual  $\Rightarrow$  Heating, air conditioning; Rep. gr. 00 ; Technical data.
- ◆ If leak UV leak detection additive was injected during a previous repair of the refrigerant circuit, observe the following: do not inject new UV leak detection additive unless the refrigerant machine oil has been replaced. If only some of the refrigerant machine oil was replaced then only the respective amount of UV leak detection additive should be injected. If, for example, 50 ml of refrigerant oil is replaced in a vehicle with 150 ml of refrigerant oil, inject only 1.0 ml ( $\text{cm}^3$ ) of UV leak detection additive.

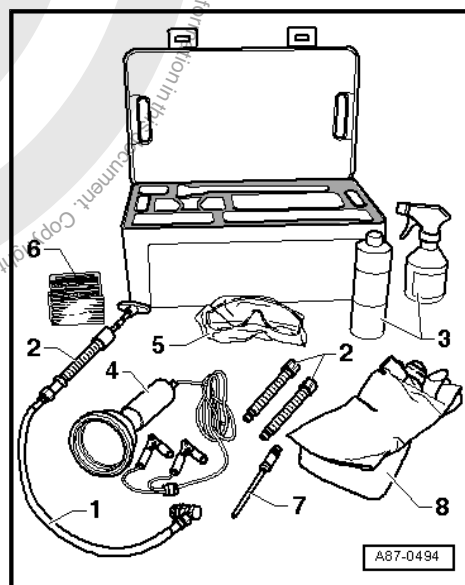
The leak detection system comprises the following parts:

- ◆ Cleaning agent -3-
- ◆ UV leak detection lamp -4-
- ◆ UV absorbing eye protection -5-
- ◆ Sticker -6-
- ◆ Gloves -8-



## Note

Items -1-, -2- and -7- in the diagram can be disregarded.



## Special tools and workshop equipment required

- ◆ Leak detecting system
- ◆ Air conditioner service station with means of adding UV leak detection additive in the refrigerant circuit  $\Rightarrow$  Electronic parts catalogue.
- ◆ Approved leak detection additive  $\Rightarrow$  Electronic parts catalogue.
- Evacuate the refrigerant circuit as per the instructions, and charge the system with UV leak detection additive and refrigerant  $\Rightarrow$  [“2.5 Evacuating refrigerant circuit”, page 134](#) and  $\Rightarrow$  [“2.6 Charging refrigerant circuit”, page 140](#).
- Wait until the pressures on the high pressure and low pressure side have settled.





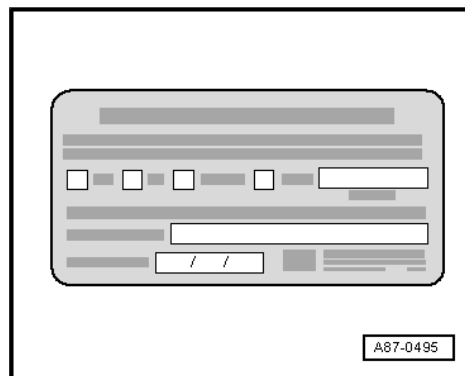
- Detach the air conditioner service station from the refrigerant circuit and switch off  
⇒ ["2.8 Switching off air conditioner service station and separating from refrigerant circuit", page 145](#) .







- Attach a label close to the service connections that shows that the refrigerant circuit has been injected with a UV leak detection additive.
- Remove any remains of UV leak detection additive from the service connection e.g. with absorbent paper, and clean the area with cleaning agent - VAS 6201/3- .
- Seal service connection with cap.
- Bring the air conditioning system into operation.
- Run the air conditioning system for at least 60 minutes with the air conditioner compressor switched on.
- Search for leaks in the refrigerant circuit using a UV lamp  
⇒ [page 74](#) .



#### Searching for leaks in refrigerant circuit using a UV lamp

##### CAUTION

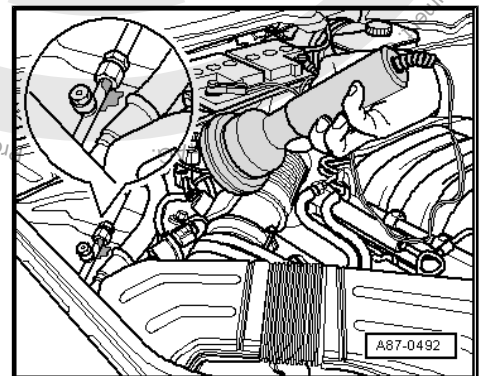
Risk of eyes being dazzled by UV light.

- Wear protective goggles.
  - Never glare into the UV lamp.
  - Never point a UV lamp at another person.
- 
- On vehicles with high-voltage system, switch off "stationary air conditioning" function (deactivate)⇒ Owner's Manual and ⇒ Operating instructions of infotainment/MMI .
  - Switch off ignition.



#### Note

- ◆ *The air conditioning system must be operated for at least 60 minutes to ensure that the injected leak detecting additive is distributed throughout the entire refrigerant circuit (air conditioner compressor must run). The leak may become visible under UV light after a short period, but this depends on the size of the leak.*
  - ◆ *Depending on the size and location of the leak, it can take several days until sufficient refrigerant oil with UV leak detection additive has leaked out and the leak can be easily identified as such.*
  - ◆ *In the event of leaks at the evaporator, the additive may be washed out with the condensate and emerge via the condensate drain. As the evaporator is not accessible on the majority of models without a great amount of work, a check of the condensed water drain point can indicate a leaking evaporator. This does however require the additive to have been in the refrigerant circuit for a lengthy period (several days).*
  - ◆ *The protective eye wear is not only required to protect the eyes. It also amplifies the illumination of the UV leak detection additive under the UV lamp.*
  - ◆ *Depending on how easy it is to reach various components in the refrigerant circuit, it may be necessary to remove certain parts from the vehicle (e.g. bumper or air filter).*
  - ◆ *Only a small amount of refrigerant oil reaches certain areas of the refrigerant circuit during operation of the air conditioning system (e.g. a cap fitted at the top of a receiver installed on the condenser). If there is a leak in these areas, it may take quite some time before a sufficient quantity of refrigerant with refrigerant oil and additive escapes at this point and can be lit up under UV light showing where the leak is. At these points, therefore, it may be more pertinent to search for a leak using an electronic leak detection device  
⇒ ["1.4.2 Searching for leaks in refrigerant circuits using an electronic leak detector", page 68](#).*
- Position the vehicle in a darker area of the workshop (in daylight or under strong lighting the effect of the UV lamp is greatly reduced).
  - Check accessibility to various components of the refrigerant circuit and remove parts in the vicinity of the refrigerant circuit that obstruct the view of the refrigerant circuit components (e.g. noise insulation and bumper).
  - Protect eyes with safety goggles.
  - Connect UV lamp to a 12 V battery (vehicle battery). Ensure that the polarity of the connections is correct.
  - Switch on the UV lamp and light up the components in the refrigerant circuit. Positions at which refrigerant - along with refrigerant oil and leak detection additive - can leak out fluoresce (light-up) under UV light.





#### 1.4.4 Detecting leaks in a vacuum test using air conditioner service station , or in a pressure test

All vehicles

##### CAUTION

Risk of freezing injury caused by escaping pressurised refrigerant.

There is a risk of injury to the skin and parts of the body due to freezing.

- Wear protective gloves.
- Wear protective goggles.
- Extract refrigerant and open the refrigerant circuit immediately afterwards.
- If more than 10 minutes have passed since the refrigerant was extracted, repeat the extraction process before opening the refrigerant circuit. Pressure could build up in the refrigerant circuit from continued evaporation.

- Switch off ignition.
- ♦ Detecting leaks in a vacuum test using air conditioner service station , or in a pressure test  
⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#)



##### Note

- ♦ *Smaller leaks in the refrigerant circuit (less than 100 g refrigerant loss per year) cannot usually be found by means of the vacuum test or pressure test. The amount of air entering the system or the nitrogen-air escaping it is too low to detect the faulty area through noise.*
  - ♦ *It is also not always possible to detect leaks in the refrigerant circuit with more than 100 g refrigerant loss per year by means of the vacuum test or pressure test, depending on the environmental conditions (noise around the area, location of leak, etc.). The air entering the system and nitrogen escaping it could be too low to generate a noise that would be noticeable in the faulty area.*
  - ♦ *Larger leaks in the refrigerant circuit (e.g. more than 100 g refrigerant loss per day caused by a stone hitting the condenser) can be detected depending on the environmental conditions, e.g. noise coming from the faulty area, which is noticeable during the vacuum test or pressure test  
⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) .*
- Perform vacuum or pressure test ⇒ [page 137](#) .

#### 1.4.5 Detecting leaks in a pressure test (with nitrogen or compressed air)

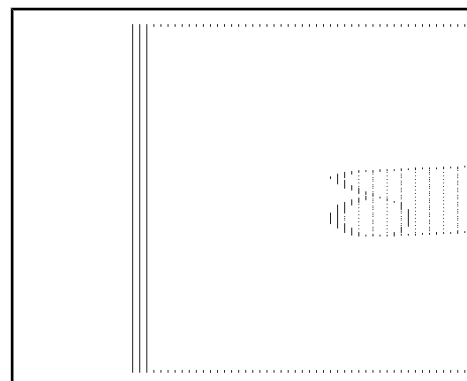
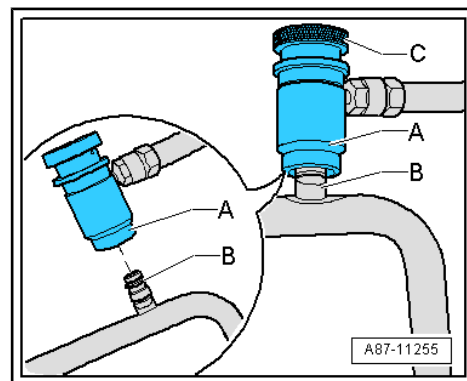
- ♦ Perform a vacuum test using the air conditioner service station to see if any leaks can be found  
⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) . If a leak can be detected but not the exact location of the leak, an additional pressure test can be performed using nitrogen or compressed air ⇒ [page 137](#)



## Note

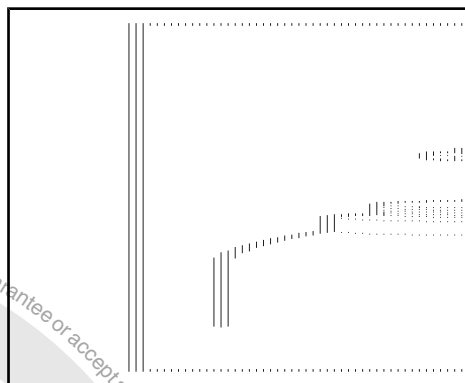
- ◆ *Smaller leaks in the refrigerant circuit (less than 100 g refrigerant loss per year) cannot usually be found by means of the vacuum test or pressure test. The amount of air entering the system or the nitrogen-air escaping it is too low to detect the faulty area through noise.*
- ◆ *It is also not always possible to detect leaks in the refrigerant circuit with more than 100 g refrigerant loss per year by means of the vacuum test or pressure test, depending on the environmental conditions (noise around the area, location of leak, etc.). The air entering the system and nitrogen escaping it could be too low to generate a noise that would be noticeable in the faulty area.*
- ◆ *Larger leaks in the refrigerant circuit (e.g. more than 100 g refrigerant loss per day caused by a stone hitting the condenser) can be detected depending on the environmental conditions, e.g. noise coming from the faulty area, which is noticeable during the vacuum test or pressure test  
⇒ **"2.5 Evacuating refrigerant circuit", page 134**.*
- ◆ *A larger leak in the refrigerant circuit can be detected, for example, by pressurising the circuit to a maximum of 15 bar using cleaned and dried compressed air or nitrogen ⇒ **page 118**. If the leak is large enough, the leakage point can be detected by sound as the gas escapes.*

Tools required:





- ◆ Quick-release coupling adapter -A- (you can also unscrew the adapter from your air conditioner service station and use it for this test).
  - ◆ Charge hose -A- (e.g. with a M12 x 1.5-6G thread, SAE J639 standard), depending on the thread of the quick-release coupling adapter (cut off), with a suitable adapter -B- (for connection to the compressed air system used in your workshop or to a pressure reducer for nitrogen)
  - ◆ Combination fine filter element for compressed air system with an oil, dirt and water separator (to ensure that the refrigerant circuit is pressurised with compressed air that is clean, dry and free of oil) for the leakage test with compressed air
  - ◆ Manifold gauge with pressure reducer for nitrogen (maximum reduced pressure: 15 bar) -1-, a full nitrogen gas cylinder -3- and a charge hose -2- (e.g. with M12 x 1.5-6G thread in accordance with SAE J639, to which a quick-release coupling adapter for service connection is fitted) for leakage test with nitrogen
- Perform pressure test ⇒ [page 137](#) .



## 1.5 Renewing components

⇒ [“1.5.1 General information about renewing components”, page 78](#)

⇒ [“1.5.2 Renewing leaking or damaged components of empty refrigerant circuit \(apart from air conditioner compressor and receiver\)”, page 80](#)

⇒ [“1.5.3 Renewing leaking or damaged components of charged refrigerant circuit \(apart from air conditioner compressor and receiver\)”, page 83](#)

⇒ [“1.5.4 Renewing air conditioner compressor with no need to clean refrigerant circuit”, page 84](#) .

⇒ [“1.5.5 Renewing air conditioner compressor due to leaks or internal damage”, page 86](#)

⇒ [“1.5.6 Renewing desiccant cartridge / receiver after cleaning refrigerant circuit”, page 87](#)

⇒ [“1.5.7 Renewing receiver with no need to clean refrigerant circuit”, page 89](#) .

⇒ [“1.5.8 Renewing desiccant cartridge / desiccant bag with no need to clean refrigerant circuit”, page 90](#)

### 1.5.1 General information about renewing components

The receiver or desiccant cartridge need not be renewed under the following circumstances:

- ◆ The opened refrigerant circuit is sealed immediately with clean plugs, e.g. from the engine bung set - VAS 6122- .
- ◆ After an accident in which there was no damage to the receiver.
- ◆ Repairs are performed quickly (not for longer than the normal repair time).
- ◆ The vehicle is no more than 5 years old.



**The receiver or dryer cartridge should be renewed under the following circumstances:**

- ◆ The refrigerant circuit has been opened for an indeterminate period (seepage leak).
- ◆ The receiver is damaged (e.g. in an accident).
- ◆ Repairs are performed over a longer time than the normal repair time.
- ◆ The refrigerant circuit was opened and the vehicle is more than 5 years old.
- ◆ The refrigerant circuit has been blown through with nitrogen.
- ◆ The refrigerant circuit has been flushed with R1234yf.
- ◆ The air conditioner compressor seizes.
- All components of the refrigerant circuit that were submitted to quality monitoring must be sealed (use the original sealing caps from the replacement part).
- Renew damaged or leaky components of the refrigerant circuit ⇒ [page 78](#) .
- All components of the refrigerant circuit that were submitted to quality monitoring must be sealed (use the original sealing caps from the replacement part).
- The replacement air conditioner compressor, receiver, evaporator and condenser were previously charged with nitrogen. This filling is being gradually discontinued, or the pressure of the nitrogen filling is so low that escaping gas is no longer perceptible when the part is initially opened.
- Where vehicles are fitted with an air conditioner compressor without a magnetic clutch, the engine should be started only when the refrigerant circuit has been fully assembled (since the air conditioner compressor will always run when the engine is running) .
- The air conditioner compressor with air conditioner compressor regulating valve - N280- (without air conditioning system magnetic clutch - N25- ) is switched to internal lubrication in the event of an empty refrigerant circuit, in which case only a small amount of oil is pumped from the air conditioner compressor into the circuit.





#### Note

- ◆ *The following replacement parts (air conditioner compressor, receiver, evaporator and condenser) could be filled with nitrogen gas, though this filling is not always guaranteed. Therefore, little or no pressure equalisation may be perceived when the sealing plugs of the replacement part are unscrewed.*
- ◆ *Depending on the storage location and storage period, it is possible on components filled with nitrogen ex-works that barely any pressure equalisation - if at all - is perceptible and, as such, nothing can be said about the leak-tightness of the component. This means, for example, that the nitrogen gas filling could escape through the shaft seal of a replacement air conditioner compressor in the course of time, even though the air conditioner compressor is leak-tight.*
- ◆ *Since spare parts are sometimes stored for long periods in various places, there is a good chance that gas may escape from some parts when first opened but not from others (even of the same part number). Therefore, be careful when unscrewing the sealing caps from the replacement part connections, and allow the nitrogen gas to escape slowly.*
- ◆ *One or 2 expansion valves and a receiver or desiccant container are installed in the refrigerant circuit ➤ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .*
- ◆ *Renew the desiccant cartridge or components with desiccant bag (receiver) after cleaning the refrigerant circuit (flush with R1234yf refrigerant ➤ ["1.6 Cleaning refrigerant circuit", page 91](#) ). When doing so, keep the circuit closed for as long as possible to keep the ingress of moisture as low as possible.*
- ◆ *Seal open connections and pipes (to prevent absorption of moisture).*



#### Note

*Contaminated refrigerant oils are to be disposed of as used oil of unknown origin (observe local regulations) ➤ VW / Audi Service-Net .*

## 1.5.2 Renewing leaking or damaged components of empty refrigerant circuit (apart from air conditioner compressor and receiver)

The refrigerant circuit was completely empty (e.g. larger leaks or ruptured hose line)

- ◆ Observe the general information about renewing components ➤ ["1.5.1 General information about renewing components", page 78](#)





#### Note

- ◆ *If there is just a small leak and the refrigerant only escaped in small quantities (e.g. small leakage point), the amount of refrigerant oil that escapes and the degree of moisture ingress are not enough to impair the function of the air conditioning system once the repair has been carried out.*
- ◆ *The measures marked with \* should only be performed if leaks are more pronounced (e.g. following an accident).*

#### Electrical air conditioner compressor

- Remove defective component \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Remove electrical air conditioning compressor and clean (flush with R1234yf refrigerant) \*  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing electrical air conditioning compressor (vehicle-specific workshop manual).
- Clean the refrigerant circuit (flush with R1234yf refrigerant)\*  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
- Completely charge the air conditioner compressor or refrigerant circuit with the requisite amount of oil  
⇒ [“1.5.4 Renewing air conditioner compressor with no need to clean refrigerant circuit”, page 84](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (approved refrigerant oils and fill capacities for refrigerant oil in vehicle-specific workshop manual).

#### Mechanical air conditioner compressor

- Remove defective component \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Remove air conditioner compressor.\* ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .

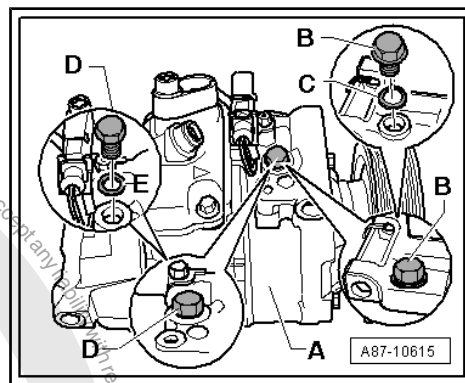


- Unscrew oil drain plug -B- / -D- from air conditioner compressor -A-.\*



#### Note

- ◆ The design of the oil drain plug -B- / -D- and seal -C- / -E- may vary (depending on the manufacturer of the air conditioner compressor) ⇒ Heating, air conditioning; Rep. gr. 87; Air conditioner compressor (vehicle-specific workshop manual).
  - ◆ When installing the oil drain plug -B- / -D-, observe the corresponding torque specification (depending on the manufacturer of the air conditioner compressor and the design of the oil drain plug). Please note that the oil drain plug of air conditioner compressors manufactured by Denso and Delphi is equipped with an oil seal ⇒ Heating, Air conditioning; Rep. gr. 87; Air conditioning compressor, Assembly overview - drive unit of air conditioner compressor (currently valid specified torque: 30 Nm for "Denso" and 15 Nm for "Delphi" air conditioner compressor). The oil drain plug of air conditioner compressors manufactured by "Sanden" and "Zexel- / Valeo" may be equipped with an O-ring or an oil seal (depending on the vehicle equipment; currently valid specified torque: 10 Nm, respectively).
  - ◆ On the Denso air conditioner compressor, for example, the oil drain plug -D- has an oil seal -E-; renew ⇒ Heating, air conditioning; Rep. gr. 87; Air conditioner compressor (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .
  - ◆ On the Sanden air conditioner compressor, for example, the oil drain plug -B- has a seal -C-; renew ⇒ Heating, air conditioning; Rep. gr. 87; Air conditioner compressor (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .
  - ◆ If the seal fitted on the oil drain plug is not available as a replacement part, it may be reused. However, check before reinstalling to ensure that it is not damaged. Replace with a commercially available seal if necessary.
  - ◆ After filling the refrigerant circuit, check the installed oil drain plug for leaks using e.g. an electronic leak detector.
  - ◆ To speed up draining of the refrigerant oil, rotate the shaft of the air conditioner compressor e.g. using the belt pulley or the magnetic clutch pulley.
- Pour out old refrigerant oil from the air conditioner compressor \*
- ⇒ ["1.5.4 Renewing air conditioner compressor with no need to clean refrigerant circuit", page 84](#) (disposal ⇒ VW / Audi ServiceNet ).





## All vehicles



### Note

- ◆ *Then pour new refrigerant oil in the air conditioner compressor in a volume that equates to the refrigerant oil in the replacement compressor \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; refrigerant oil .*
- ◆ *Different refrigerant oil and volumes for different air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; refrigerant oil .*
- ◆ *To ensure proper lubrication of the air conditioner compressor when it runs for the first time, the air conditioner compressor must be filled with at least 40 cm<sup>3</sup> of refrigerant oil; the remainder can be poured e.g. into the new reservoir or receiver or a refrigerant line ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; refrigerant oil .*
- ◆ *If dirt enters the air conditioner compressor whilst the refrigerant circuit is open (e.g. after an accident), the air conditioner compressor is to be renewed ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .*
- ◆ *Clean the refrigerant circuit (flush with R1234yf refrigerant) \* ⇒ "1.6 Cleaning refrigerant circuit", page 91 .*
- Renew desiccant cartridge and receiver ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Assemble the refrigerant circuit, evacuate and refill ⇒ [page 123](#) .

### 1.5.3 Renewing leaking or damaged components of charged refrigerant circuit (apart from air conditioner compressor and receiver)

There is still refrigerant in the refrigerant circuit (e.g. the leak is small)

- ◆ Observe the general information about renewing components ⇒ ["1.5.1 General information about renewing components", page 78](#)
- Drain refrigerant circuit ⇒ [page 123](#) .
- Remove the defective part, blow through with compressed air and collect any escaping refrigerant oil.
- The refrigerant oil that is blown out (plus 20 cm<sup>3</sup> for the evaporator, plus 10 cm<sup>3</sup> for the condenser, refrigerant lines and refrigerant hoses) should be poured into the new component as fresh refrigerant oil.



### Note

Dispose of old refrigerant oil (observing local regulations) ⇒ VW / Audi ServiceNet .

- Assemble the refrigerant circuit, evacuate and charge ⇒ [page 123](#) .



## 1.5.4 Renewing air conditioner compressor with no need to clean refrigerant circuit



### Note

*Clean the refrigerant circuit. In other words, flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .*

- ◆ Observe the general information about renewing components ⇒ ["1.5.1 General information about renewing components", page 78](#)

**For example with external damage from an accident**

- Drain refrigerant circuit ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .
- Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .

### Electrical air conditioner compressor

- Flush the defective electrical air conditioning compressor to remove the refrigerant oil (make a note of the volume of refrigerant oil flushed out)  
⇒ ["2.11 Cleaning electrical air conditioning compressor", page 149](#) .



### Note

- ◆ *If the volume of refrigerant oil flushed out of the defective air conditioner compressor is more than 75% of that in the replacement air conditioner compressor, do not flush the replacement air conditioner compressor (a residual amount always remains in the air conditioner compressor, which means that the amount of refrigerant oil in the refrigerant circuit is negligible).*
- ◆ *If less than 75% of the specified amount of refrigerant oil is flushed out of the defective air conditioner compressor, the remaining amount is still in the components of the refrigerant circuit. To prevent the system from being overfilled with refrigerant oil, the refrigerant circuit or the electrical air conditioning compressor is to be flushed.*
- Flush the refrigerant circuit or new electrical air conditioning compressor to remove the refrigerant oil  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) and  
⇒ ["2.11 Cleaning electrical air conditioning compressor", page 149](#) .
- Dispose of refrigerant oil flushed out of defective and new air conditioner compressor / refrigerant circuit ⇒ VW / Audi ServiceNet (observe local regulations).



### Note

*The design of the electrical air conditioning compressor is such that flushing is a requisite to remove the refrigerant oil (the refrigerant oil cannot be poured out as is the case with mechanical air conditioning compressors with oil drain plug)  
⇒ ["1.5.2 Renewing leaking or damaged components of empty refrigerant circuit \(apart from air conditioner compressor and receiver\)", page 80](#) .*



- Only fill the replacement air conditioner compressor with fresh refrigerant oil equivalent to volume of oil that was flushed out (from the defective air conditioner compressor).



#### Note

- ◆ *If for instance 70 cm<sup>3</sup> refrigerant oil was poured out of the defective air conditioner compressor, and 140 cm<sup>3</sup> oil was poured out of the replacement air conditioner compressor (a small quantity of refrigerant oil remains in the air conditioner compressor and potentially in the air conditioner service station). The air conditioner compressor to be installed must be filled in this instance with 70 cm<sup>3</sup> of refrigerant oil (the refrigerant oil flushed out of the replacement air conditioner compressor must not be used as it may have been contaminated in the air conditioner service station).*
- ◆ *Different refrigerant oils and volumes for different air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .*
- ◆ *If quite a large amount of refrigerant oil was flushed out of the defective air conditioner compressor (more than approx. 40 cm<sup>3</sup>), the remaining refrigerant oil can also be poured in the evaporator, a refrigerant line or the reservoir/receiver/inner heat exchanger ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit , ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .*

#### Mechanical air conditioner compressor

- Remove oil drain plug from air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .



#### Note

*If the seal fitted on the oil drain plug is not available as a replacement part, it may be reused. However, check before reinstalling to ensure that it is not damaged. Replace with a commercially available seal if necessary.*

- To speed up draining of the refrigerant oil, rotate the shaft of the air conditioner compressor using e.g. the magnetic clutch pulley.
- Pour out old refrigerant oil from the air conditioner compressor and dispose ⇒ VW / Audi-ServiceNet (observe local regulations).
- Remove oil drain screw from replacement air conditioner compressor, pour out refrigerant oil and replace it with only the quantity of fresh refrigerant oil equal to the amount of refrigerant oil poured out of the defective air conditioner compressor ⇒ “1.5.2 Renewing leaking or damaged components of empty refrigerant circuit (apart from air conditioner compressor and receiver)”, page 80 .





## Note

- ♦ If for instance 50 cm<sup>3</sup> refrigerant oil was poured out of the defective air conditioner compressor, and 100 cm<sup>3</sup> oil was poured out of the replacement air conditioner compressor (a small quantity of refrigerant oil remains in the air conditioner compressor), pour 50 cm<sup>3</sup> refrigerant oil into the replacement air conditioner compressor (the refrigerant oil previously poured from the air conditioner compressor spare part may be used).
- ♦ Different refrigerant oils and volumes for different air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .
- ♦ If quite a large amount of refrigerant oil was poured out of the defective air conditioner compressor (more than approx. 50 cm<sup>3</sup>), the remaining refrigerant oil can also be poured in the evaporator or reservoir/receiver/inner heat exchanger ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .

## All

- Renew restrictor (only if installed in this refrigerant circuit).
- Assemble the refrigerant circuit, evacuate and charge  
⇒ [page 123](#) .

### 1.5.5 Renewing air conditioner compressor due to leaks or internal damage

- ♦ Observe the general information about renewing components  
⇒ [“1.5.1 General information about renewing components”](#),  
[page 78](#)

#### Vehicles with high-voltage system (hybrid vehicles)

- Observe the risk category of the high-voltage system ⇒ Rep. gr. 00 ; Risk category of the high-voltage system .
- Observe safety precautions when working on the high-voltage system  
⇒ [“1.5 Safety measures for working on vehicles with high-voltage system”](#), [page 3](#) .
- Observe safety precautions when working in the vicinity of high-voltage components  
⇒ [“1.6 Safety precautions when working in the vicinity of high-voltage components”](#), [page 4](#) .

## All vehicles

Renew air conditioner compressor e.g. owing to noise from the air conditioner compressor or lack of performance.

- Drain refrigerant circuit ⇒ [page 123](#) .
- Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .
- Clean refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”](#), [page 91](#) .



#### Note

- ◆ *In the event of internal damage (to the air conditioner compressor), check the refrigerant hoses and condenser. If contaminated by swarf, for example, clean the refrigerant hoses and condenser (flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#)); renew refrigerant hoses if necessary.*
- ◆ *On certain vehicles (e.g. vehicles with 2 evaporators), the volume of refrigerant oil in the refrigerant circuit may be greater than the volume in the replacement air conditioner compressor. Replenish the refrigerant circuit on these vehicles with the amount of refrigerant oil necessary ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific workshop manual).*
- ◆ *In the event of a fault in the electronics of an electrical air conditioning compressor (e.g. control unit for air conditioning compressor - J842- defective), the refrigerant circuit need not be flushed. In this case, the air conditioner compressor is to be renewed without there being a requirement to clean the refrigerant circuit ⇒ ["1.5.4 Renewing air conditioner compressor with no need to clean refrigerant circuit", page 84](#)*
- Renew desiccant bag/desiccant cartridge (reservoir/receiver) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit.
- Check expansion valve for contamination or corrosion, renew if necessary ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit.
- Assemble the refrigerant circuit, evacuate and charge ⇒ [page 123](#).

### 1.5.6 Renewing desiccant cartridge / receiver after cleaning refrigerant circuit



#### Note

*Installed in the receiver is usually a desiccant cartridge or desiccant bag (depending on the layout of the refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit*

- ◆ Observe the general information about renewing components ⇒ ["1.5.1 General information about renewing components", page 78](#)



#### Note

*Clean the refrigerant circuit. In other words, flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#).*

For example due to moisture ingress (the refrigerant circuit was open for too long) or contamination

- Drain refrigerant circuit ⇒ [page 123](#).
- Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87; Air conditioner compressor.





- Rectify cause of fault ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Clean refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .

#### Electrical air conditioner compressor

- Flush air conditioner compressor of old refrigerant oil  
⇒ [“2.11 Cleaning electrical air conditioning compressor”, page 149](#) .

#### Mechanical air conditioner compressor

- Remove oil drain plug from air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .



#### Note

*Different versions of oil drain plug and corresponding seal, renew  
⇒ [“1.5.2 Renewing leaking or damaged components of empty refrigerant circuit \(apart from air conditioner compressor and receiver\)”, page 80](#) , ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*

- To speed up draining of the refrigerant oil, rotate the shaft of the air conditioner compressor e.g. using the belt pulley or the magnetic clutch pulley ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .
- Pour out old refrigerant oil from air conditioner compressor  
⇒ [“1.5.4 Renewing air conditioner compressor with no need to clean refrigerant circuit”, page 84](#) .



#### Note

*Dispose of old refrigerant oil (observing local regulations) ⇒ VW / Audi ServiceNet .*

#### All air conditioner compressors

- Check expansion valve for contamination or corrosion, renew if necessary ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Then fill the air conditioner compressor with new refrigerant oil by the same amount of refrigerant oil filled in the replacement air conditioner compressor (or by the specified amount of refrigerant oil if the vehicle is fitted with 2 evaporators) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; Refrigerant oil .



#### Note

- ◆ Different refrigerant oils and volumes for different air conditioner compressors ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).
- ◆ To ensure proper lubrication of the air conditioner compressor when it runs for the first time, the air conditioner compressor must be filled with at least 40 cm<sup>3</sup> of refrigerant oil; the remainder can be poured e.g. into a refrigerant line or the new reservoir/receiver/inner heat exchanger  
⇒ ["1.5.1 General information about renewing components", page 78](#) , ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .
- ◆ If dirt enters the air conditioner compressor while the refrigerant circuit is open (e.g. after an accident), the refrigerant circuit must be cleaned and the air conditioner compressor renewed  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor .
- ◆ On vehicles with 2 evaporators, the volume of refrigerant oil in the refrigerant circuit may be greater than the volume in the replacement air conditioner compressor. Replenish the refrigerant circuit with the amount of refrigerant oil necessary ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).
- Renew desiccant bag/desiccant cartridge (receiver) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Assemble the refrigerant circuit, evacuate and charge  
⇒ [page 123](#) .

### 1.5.7 Renewing receiver with no need to clean refrigerant circuit



#### Note

Installed in the receiver is usually a desiccant cartridge or desiccant bag (depending on the layout of the refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit

- ◆ Observe the general information about renewing components  
⇒ ["1.5.1 General information about renewing components", page 78](#)



#### Note

Clean the refrigerant circuit. In other words, flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .

- ◆ For example, refrigerant has leaked out but no dirt has entered the circuit.
- ◆ If the gas analysis shows that contaminated refrigerant was in the circuit but there appears to be no problem with the function of the air conditioning system  
⇒ ["2.3 Performing gas analysis of refrigerant", page 128](#)
- Drain refrigerant circuit ⇒ [page 123](#) .



- Remove receiver ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Remove dirt from receiver.
- Weigh removed receiver.
- Fill enough refrigerant oil into the new receiver so that it has the same weight as the item that was removed.
- Install new receiver ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Assemble the refrigerant circuit, evacuate and charge  
⇒ [page 123](#) .

### 1.5.8 Renewing desiccant cartridge / desiccant bag with no need to clean refrigerant circuit



#### Note

*Desiccant cartridges or desiccant bags are usually installed depending on the layout of the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit*

- ♦ Observe the general information about renewing components  
⇒ [“1.5.1 General information about renewing components”, page 78](#)



#### Note

*Clean the refrigerant circuit. In other words, flush with R1234yf refrigerant ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .*

- ♦ For example, refrigerant has leaked out but no dirt has entered the circuit.
- ♦ If the gas analysis shows that contaminated refrigerant was in the circuit but there appears to be no problem with the function of the air conditioning system  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#)
- Drain refrigerant circuit ⇒ [page 123](#)
- Renew desiccant cartridge/desiccant bag ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



#### Note

*If the desiccant cartridge/desiccant bag is permanently installed in a component (e.g. in the receiver on the condenser) and cannot be renewed individually, renew the receiver or condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .*

- Assemble the refrigerant circuit, evacuate and charge  
⇒ [page 123](#) .



## 1.6 Cleaning refrigerant circuit

⇒ [“1.6.1 General information about cleaning refrigerant circuit”, page 91](#)

⇒ [“1.6.2 Preparations for cleaning refrigerant circuit \(flushing with R1234yf refrigerant\)”, page 93](#)

⇒ [“1.6.3 Refrigerant circuit cleaning procedure”, page 96](#)

⇒ [“1.6.4 Principle circuit diagrams for cleaning \(flushing circuits\) - refrigerant circuit with expansion valve and receiver”, page 97](#)

⇒ [“1.6.5 Principle circuit diagrams for cleaning \(flushing circuits\) - refrigerant circuit with restrictor and receiver \(without high-voltage system\)”, page 102](#)

⇒ [“1.6.6 Principle circuit diagrams for cleaning \(flushing circuits\) - vehicles with high-voltage system \(without auxiliary air conditioning functions\)”, page 105](#)

⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)

⇒ [“1.6.8 General information about blowing through with compressed air or nitrogen”, page 114](#)

⇒ [“1.6.9 Blowing through refrigerant circuit with compressed air or nitrogen”, page 118](#)

### 1.6.1 General information about cleaning refrigerant circuit



#### Note

- ◆ *Work on the refrigerant circuit that involves the air conditioner service station can usually be carried out without the need to de-energise the high-voltage system.*
- ◆ *Since certain components have to be removed to clean (flush) the refrigerant circuit, the high-voltage system must be de-energised before work commences ⇒ Electrical system - hybrid; Rep. gr. 93 : Electric drive; General warning notices for work on high-voltage system .*
- ◆ *If there is reason to believe that chemical substances (leak stop additives) have been poured in the refrigerant circuit (that is be flushed) to seal leaks, do not connect your air conditioner service station to this refrigerant circuit and do not flush this refrigerant circuit.*
- ◆ *Chemical substances (leak stop additives) used to seal leaks form deposits in the refrigerant circuit. These can impair the function of the air conditioning system and cause the air conditioning system (and your air conditioner service station) to fail.*
- ◆ *Bring the customer's attention to the presence of substances in the air conditioning system that are not approved by Volkswagen/Audi, which prevent the air conditioning system from being flushed and repaired.*



## All vehicles



### Note

- ♦ *VW/Volkswagen/Audi does not endorse the use of chemical substances (leak inhibitor additives) for purposes of sealing leaks in refrigerant circuits.*
- ♦ *These chemical substances (leak stop additives) react mostly with the ambient air or the humidity to stop leaks in the refrigerant circuit. They cause deposits to build up in the refrigerant circuit (and your air conditioner service station), cause valves to malfunction and defects in other components with which they come into contact. These deposits cannot be completely removed from the components again (not even by flushing). The refrigerant circuit can only be repaired by replacing all components that have come into contact with this substance.*
- ♦ *There are often no external signs to suggest that chemical substances (leak stop additives) have been used to seal leaks in a refrigerant circuit. Often, the stickers provided to mark such systems are missing. Therefore, exercise caution on vehicles for which you have no service or repair record.*
- ♦ *If there is no suitable air conditioner service station available for the R1234yf refrigerant, the air conditioner service station designed for R134a refrigerant may also be used and the refrigerant circuit may also be flushed with R134a refrigerant. Using R134a refrigerant to clean the refrigerant circuit is currently permissible ⇒ Air conditioning system with R134a refrigerant; Rep. gr. 87 ; General information about the air conditioning system and refrigerant circuit .*
- ♦ *If during the gas analysis it is found that R1234yf refrigerant has been contaminated with a different gas, it must be extracted from the refrigerant circuit and disposed of as a gas of unknown composition in accordance with the relevant legislation ⇒ VW / Audi-ServiceNet and [⇒ "2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal", page 155](#) .*
- ♦ *Contaminated refrigerant can cause decomposition products to form and accumulate in the refrigerant circuit. These cannot be extracted with the refrigerant. The contaminated refrigerant oil, in this case, must be removed from the refrigerant circuit by flushing with refrigerant.*
- To work as cleanly as possible, without being wasteful of the refrigerant, without complex assembly work and in an environmentally friendly manner when removing moisture, contaminants (e.g. friction dust and particles from the defective air conditioner compressor) and old refrigerant oil, the refrigerant circuit must be flushed (using R1234yf refrigerant).

### The refrigerant circuit must be cleaned (flushed) with refrigerant R1234yf:

- If dirt or other contamination is in the circuit.
- The search for faults in the electrical system, the vacuum system and the air ducts did not turn up any fault. (Moisture is in the refrigerant circuit and builds up pressure.)
- If the refrigerant circuit has been left open for longer than normally required for repairs (e.g. following an accident).
- Pressure and temperature measurements in the circuit indicate that there is moisture in the refrigerant circuit.
- There is doubt about the amount of refrigerant oil in the refrigerant circuit.





- Under certain circumstances if contaminated R1234yf refrigerant was charged in the refrigerant circuit  
⇒ [“1.5 Renewing components”, page 78](#) and  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#)



#### Note

*If contaminated refrigerant is found and components of the refrigerant circuit exhibit signs of internal damage (e.g. corrosion on the inside of the refrigerant lines or breakdown of the inner layer of refrigerant hoses), flushing the refrigerant circuit may not be sufficient. In this case, all of the components of the refrigerant circuit must be renewed (owing to a gas being charged that severely damaged the components).*

- The air conditioner compressor has to be exchanged because of internal damage (e.g. noisy or lack of power)  
⇒ [“1.5 Renewing components”, page 78](#) .
- If it is required by the workshop manual for the specific vehicle following the renewal of certain components.

#### Tools required

- ♦ Air conditioner service station with flushing device (this air conditioner service station incorporates the auxiliary function “flushing refrigerant circuit” and the corresponding flushing device for refrigerant circuits ⇒ Electronic parts catalogue .
- ♦ Adapter case for Volkswagen/Audi passenger vehicles  
⇒ [page 105](#) and ⇒ Electronic parts catalogue .



#### Note

- ♦ *If you do not have an air conditioner service station with flushing device ⇒ Electronic parts catalogue in your workshop, it may be possible depending on the version of your air conditioner service station to use the refrigerant circuit flushing device ⇒ Electronic parts catalogue to flush the refrigerant circuit. However, the flushing routine must be performed manually ⇒ [page 153](#) .*
- ♦ *In adapter case passenger vehicle set there is also a filling hose with 5/8 -18 UNF connections and large inner diameter, short type (commercially available).*

### 1.6.2 Preparations for cleaning refrigerant circuit (flushing with R1234yf refrigerant)

- Drain refrigerant circuit  
⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
- Remove air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).

#### On vehicles with restrictor and reservoir

- Remove restrictor (vehicle-specific) and join the lines together again ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- Remove the reservoir (vehicle-specific) and join the lines together again (using an adapter and the charging hose from the adapter case for VW/Audi passenger vehicles )  
⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)  
and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit



cuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



#### Note

*The reservoir could be flushed. However, due to its large interior volume it draws too much refrigerant and when this is extracted, the reservoir ices up too heavily. This causes the refrigerant to evaporate only very slowly, lengthening the extraction process too much as a result.*

On vehicles with expansion valve and receiver

- If possible and necessary with this refrigerant circuit (see notice), remove the receiver or remove the desiccant cartridge from the receiver (vehicle-specific) and join the lines together again (using an adapter and the charge hose from the adapter case for Volkswagen/Audi passenger vehicles )  
⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)  
and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



#### Note

- ◆ *Depending on the design, the receiver can be flushed (if necessary, remove dryer cartridge installed in receiver)  
⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)  
and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *If the receiver is attached to the condenser, it must not be removed for flushing (its design makes it suitable for flushing, and it is only renewed after flushing)  
⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)  
and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *With condensers in which the receiver / desiccant cartridge are integrated and cannot be renewed individually or are not available as individual parts, the condenser is to be renewed after flushing. On these vehicles, the condenser in this case is to be renewed with the receiver ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- ◆ *Depending on the version, receivers - in which the desiccant cartridge is to be renewed individually - may feature an additional filter element, which will need to be renewed with the desiccant cartridge if necessary.*
- On vehicles with a dryer cartridge in the receiver on the condenser (vehicle-specific), remove the dryer cartridge and seal the opening on the receiver again ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- Remove expansion valve (vehicle-specific) and fit an adapter from the adapter case for Volkswagen/Audi passenger vehicles in its place  
⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)  
and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



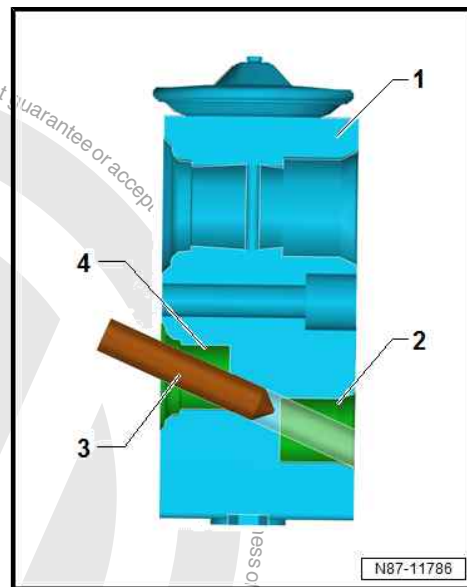


**i Note**

*If there is not a suitable adapter for the expansion valve in the adapter case VW/Audi passenger vehicle set - VAS 6338/1- or adapter case commercial vehicle set - VAS 6338/50- , the removed expansion valve can also be drilled out (the old expansion valve must be subsequently renewed).*

**i Note**

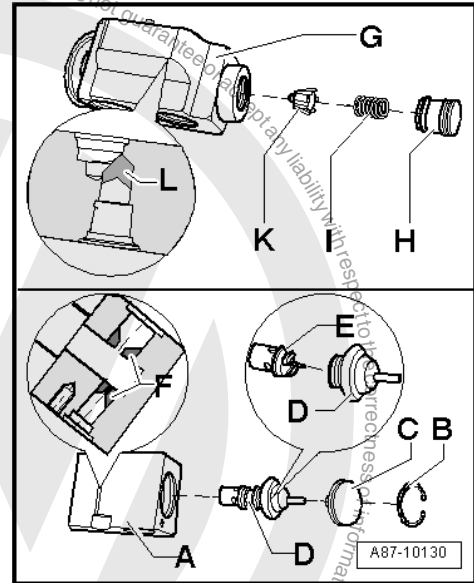
- ◆ *Disregard position -3-.*
- ◆ *When drilling out, ensure that the flow holes -2- and -4- in the expansion valve -1- are located offset to each other.*
- ◆ *Failure to observe this measure can result in the sealing surface on the expansion valve -1- becoming damaged when drilling, thereby rendering the expansion valve useless for setting up the flushing circuit.*





#### Note

- ◆ Before drilling, remove the regulator element and drill out the expansion valve using e.g. a suitably sized drill bit (diameter of drill bit e.g. 6.0 mm).
  - ◆ Before drilling out, some parts may have to be removed from the expansion valve depending on the version.
  - ◆ There are different types of expansion valve with different designs. For type -A-, parts -B-, -C- and -D- must be removed, for example. Separate component -D- and then part -E- (the regulating element). Then drill out the expansion valve in area -F- using a suitably sized drill bit.
  - ◆ On version -G-, parts -H-, -I- and -K-, for example, must be removed and then area -L- drilled out using a suitably sized drill bit.
- Clean the drilled out expansion valve of swarf (metal particles).
  - Reinstall parts -B-, -C- and -D- on type -A- or part -H- on type -G-.



#### Note

On vehicles with 2 evaporators, separate the circuit to the second evaporator from the circuit of the first evaporator and flush it in a separate work step

⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#) and  
⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).

- ◆ Clean (flush) the refrigerant circuit  
⇒ ["2.12 Cleaning refrigerant circuit", page 151](#)

### 1.6.3 Refrigerant circuit cleaning procedure



#### Note

The procedure runs automatically as per the program in the air conditioner service station ⇒ Operating instructions air conditioner service station .

- ◆ After switching on, the flushing circuit (refrigerant circuit with connecting hoses and flushing device for refrigerant circuits) is evacuated first and, in the process, the refrigerant circuit is checked for leaks (it may be necessary to proceed to the next step manually depending on the version of air conditioning service station ).
- ◆ Once the refrigerant circuit has been checked for leaks by means of evacuating, a certain amount of refrigerant is filled in the system to check the flushing/refrigerant circuit for correct assembly (pressure test).
- ◆ After the pressure test, the refrigerant is extracted, the refrigerant circuit is evacuated again, if necessary, and the cleaning (flushing) process begins.
- ◆ A predefined volume of refrigerant is charged in the refrigerant circuit via the high pressure side of the air conditioner service station (in the opposite direction of normal flow during air conditioning system operation and therefore on the low pressure side of the vehicle's refrigerant circuit). Alternatively, refriger-



ant is charged continually (depending on the internal volume of the flushing circuit e.g. 3 kg) until the refrigerant circuit and the inspection windows of the flushing device for refrigerant circuits are completely full with liquid refrigerant (the system detects, e.g. over a certain period of time, when refrigerant ceases to flow depending on the version of air conditioner service station ).

- ◆ Once the predetermined amount of refrigerant has been filled in the system, the heater, for example, of the flushing device for refrigerant circuits is switched on depending on the type of air conditioner service station and flushing device for refrigerant circuits (only if the refrigerant is extracted in gaseous form out of the flushing device for refrigerant circuits).
- ◆ When the refrigerant has been extracted, the heater of the flushing device for refrigerant circuits is switched off (if fitted), the refrigerant circuit may have to be evacuated briefly again depending on the type, and following evacuation the refrigerant oil evacuated by the air conditioner service station out of the refrigerant circuit is separated of water.
- ◆ The procedure for charging with refrigerant, extracting (and evacuating) is carried out three times (that means a total of four times).
- ◆ After extracting for the fourth time, the flushing circuit is evacuated depending on the type of air conditioner service station.

#### 1.6.4 Principle circuit diagrams for cleaning (flushing circuits) - refrigerant circuit with expansion valve and receiver

- ◆ With 1 or 2 evaporators
- ◆ With and without high-voltage system



## Note

- ◆ *The arrows in the following illustrations show the direction of refrigerant flow during flushing (during flushing, the refrigerant flows against the direction of flow with normal air conditioning operation, which is why the high pressure side of the air conditioner service station is connected on the low pressure connection of the refrigerant circuit to the air conditioner compressor).*
- ◆ *This principle circuit diagram shows a refrigerant circuit with expansion valve, receiver and a second evaporator (extra equipment on certain vehicles).*
- ◆ *On vehicles with expansion valve and receiver, the expansion valve is removed and an adapter installed in its place. The receiver is also removed depending on the vehicle and the line connections to the receiver are joined together with 2 adapters and a filling hose.*
- ◆ *On vehicles with just one evaporator, the components from position "16" are not installed or not required.*
- ◆ *Depending on the design of the air conditioner service station there may be non-return valves installed between the refrigerant circuit and the air conditioner service station (to assure the correct direction of refrigerant flow during flushing).*
- ◆ *The adapters from the adapter case for VW/Audi passenger vehicles have a 5/8 -18 UNF thread. To ensure that the charge hoses of the R1234yf- air conditioner service station can be connected, additional adapters from the case are to be used adapter case for VW/Audi passenger vehicles ➔ Electronic parts catalogue .*
- ◆ *Installed in the refrigerant circuit on vehicles with a high-voltage system are electrically actuated valves that have to be removed for cleaning (flushing) and replaced with manual shut-off valves or adapters ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .*



## 1 - Air conditioner service station

- ☐ With electronics and flushing program, air conditioner service station with flushing device  
⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning system/heating)
- ☐ If an air conditioner service station without flushing program is used, the sequence has to be carried out manually (evacuate, flush 4 times with at least 3 kg of refrigerant each time and extract refrigerant again, evacuate).

## 2 - Refrigerant hose of air conditioner service station

- ☐ From high pressure side of air conditioner service station (normally coloured red) for connecting low pressure side of air conditioner compressor to refrigerant circuit (larger diameter)

## 3 - Adapter for connection to low pressure side in refrigerant circuit

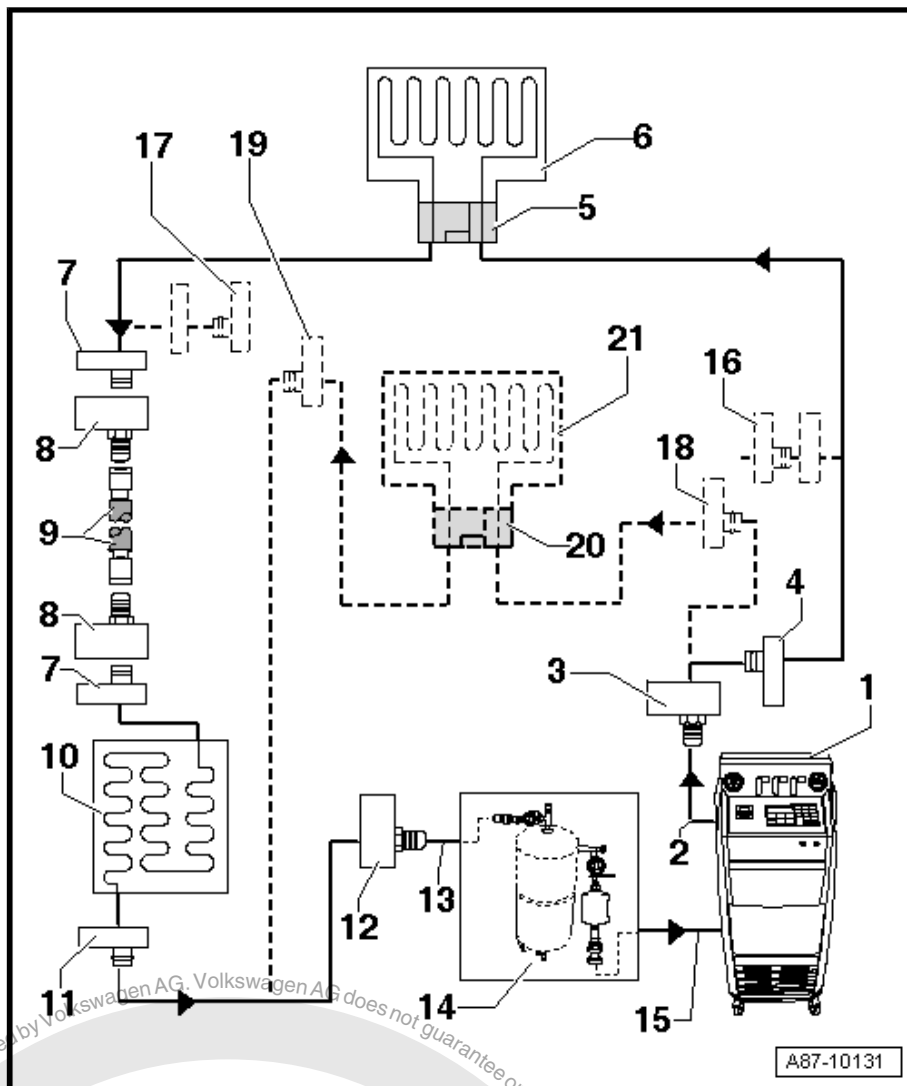
- ☐ Different versions depending on vehicle  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

- ☐ The item to be used between the refrigerant hose -2- and adapter -3- is adapter - VAS 6338/48- .
- ☐ From adapter case VW/Audi passenger vehicle set
- ☐ Depending on the version of adapter, an additional adapter is required here to connect the charge hose of the air conditioner service station



### Note

- ◆ The charge hose of the air conditioner service station has an M12 x 1.5-6G external thread in accordance with SAE J639. Located on the adapter for connection of the low pressure side is a 5/8 -18 UNF external thread. To ensure that both components can be connected together, an additional adapter is required ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning system/heating).





- ◆ *To attain the fastest flow speed possible, the service coupling is removed from the charge hose for purposes of flushing (bottle-necks are present in the service coupling that would significantly reduce the flow speed).*

#### 4 - Connection of low pressure side in refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

#### 5 - Adapter for removed expansion valve

- ❑ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ❑ From adapter case for VW/Audi passenger vehicles ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning/heating)

#### 6 - Evaporator

#### 7 - Connection to receiver

- ❑ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ❑ Not fitted in vehicles with a dryer cartridge in the receiver on the condenser or with a receiver installed in the condenser ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).

#### 8 - Adapter for bridging removed receiver

- ❑ Not required on all vehicles
- ❑ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ❑ From adapter case VW/Audi passenger vehicle set

#### 9 - Charge hose for refrigerant

- ❑ For example charge hose from adapter case VW/Audi for passenger vehicles ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

#### 10 - Condenser

- ❑ If a receiver with dryer cartridge is fitted at the condenser, the dryer cartridge must be removed (seal receiver at or in condenser again following removal) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- ❑ If the receiver is attached directly to the condenser, flush the system before removing and renewing the receiver ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).



#### Note

*On certain vehicles, the receiver is integrated in the condenser and the desiccant cartridge cannot be renewed individually or is not available individually as a replacement part. On these vehicles, the condenser in this case is to be renewed with the receiver ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit and ⇒ Electronic parts catalogue .*

#### 11 - Connection for high pressure side on refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

#### 12 - Adapter for connection of high pressure side in refrigerant circuit

- ❑ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ❑ From adapter case VW/Audi passenger vehicle set



### 13 - Charging hose of flushing device for refrigerant circuits

- ☐ From connection to high pressure side of air conditioner compressor on refrigerant circuit (smaller diameter) to inlet of flushing device for refrigerant circuits.

### 14 - Flushing device for refrigerant circuits

- ☐ Different versions and different design of flushing devices for refrigerant circuits ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning/heating)
- ☐ With filter, sight glass, safety valve, heating, refrigerant tank, etc. (depending on version).
- ☐ Depending on the design of the air conditioner service station and the flushing device for refrigerant circuits, there may be a non-return valve installed at the outlet of the flushing device for refrigerant circuits (to assure the correct direction of refrigerant flow during flushing).
- ☐ Depending on the flushing device there may be a 5/8 - 18 UNF external thread, a connection for R134a or a R1234yf high pressure service coupling at the outlet to the air conditioner service station



#### Note

- ◆ *To ensure that the flushing device can be connected to the air conditioner service station, flushing devices with a 5/8 - 18 UNF external thread or a connection for an R134a low pressure service coupling require an additional adapter to facilitate connection of the R1234yf low pressure service coupling or the charge hose to the air conditioner service station (with an M12 x 1.5-6G external thread in accordance with SAE J639) at the outlet of the flushing device.*
- ◆ *The charge hose of the air conditioner service station has an M12 x 1.5-6G external thread in accordance with SAE J639. Depending on the type of service connection, there may be a low pressure service coupling in accordance with SAE J639 for the R1234yf refrigerant, an M12 x 1.5-6G internal thread in accordance with SAE J639, a service connection for an R134a low pressure service coupling or a 5/8 - 18 UNF external thread on the flushing device for refrigerant circuits. To ensure that both components can be connected to each other, an additional adapter may be necessary ⇒ Electronic parts catalogue .*
- ◆ *Since refrigerant is only drawn in by the air conditioner service station at a low flow speed, the low pressure service coupling can be used here.*

### 15 - Refrigerant hose of air conditioner service station

- ☐ From the low pressure side of the air conditioner service station (normally coloured blue) to the outlet of the flushing device for refrigerant circuits.

### 16 - Adapter to seal outlet to second evaporator

- ☐ Only required on certain vehicles with "second evaporator" (optional equipment)
- ☐ From adapter case VW/Audi passenger vehicle set





#### 17 - Adapter to seal outlet to second evaporator

- ☐ Only required on certain vehicles with “second evaporator” (optional equipment)
- ☐ From adapter case VW/Audi passenger vehicle set

#### 18 - Connection of low pressure side in refrigerant circuit to second evaporator

- ☐ Different versions depending on vehicle ⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)
- ☐ Only fitted on certain vehicles with “second evaporator” (optional equipment)

#### 19 - Connection of high pressure side on refrigerant circuit to second evaporator

- ☐ Different versions depending on vehicle ⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)
- ☐ Only fitted on certain vehicles with “second evaporator” (optional equipment)

#### 20 - Adapter for removed expansion valve on second evaporator

- ☐ Different versions depending on vehicle ⇒ [“1.6.7 Adapters for setting up flushing circuits”, page 105](#)
- ☐ Only required on certain vehicles with “second evaporator” (optional equipment)
- ☐ From adapter case VW/Audi passenger vehicle set

#### 21 - Second evaporator

- ☐ Only fitted on certain vehicles with “second evaporator” (optional equipment)

### 1.6.5 Principle circuit diagrams for cleaning (flushing circuits) - refrigerant circuit with restrictor and receiver (without high-voltage system)



#### Note

- ◆ *On vehicles with restrictor and reservoir, the restrictor and the reservoir must be removed. The lines that were detached to remove the restrictor are reinstalled. The line connections to the removed reservoir are joined together with 2 adapters and the charge hose (from the adapter case for VW/Audi passenger vehicles).*
- ◆ *This layout with restrictor and refrigerant circuit reservoir is currently not used at Volkswagen/Audi.*
- ◆ *The arrows in the following illustrations show the direction of refrigerant flow during flushing (during flushing, the refrigerant flows against the direction of flow with normal air conditioning operation, which is why the high pressure side of the air conditioner service station is connected on the low pressure connection of the refrigerant circuit to the air conditioner compressor).*
- ◆ *Depending on the design of the air conditioner service station there may be non-return valves installed between the refrigerant circuit and the air conditioner service station (to assure the correct direction of refrigerant flow during flushing).*
- ◆ *The adapters from the adapter case for VW/Audi passenger vehicles have a 5/8 - 18 UNF thread. To ensure that the charge hoses of the R1234yf- air conditioner service station can be connected, additional adapters from the case are to be used adapter case for VW/Audi passenger vehicles.*



## 1 - Air conditioner service station

- ❑ With electronics and flushing program, e.g. air conditioner service station with flushing device ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning/heating)
- ❑ If an air conditioner service station without flushing program is used, the sequence has to be carried out manually (evacuate, flush 4 times with at least 3 kg of refrigerant each time and extract refrigerant again, evacuate).

## 2 - Refrigerant hose of air conditioner service station

- ❑ From high pressure side of air conditioner service station (normally coloured red) for connecting low pressure side of air conditioner compressor to refrigerant circuit (larger diameter)

## 3 - Adapter for connection to low pressure side in refrigerant circuit

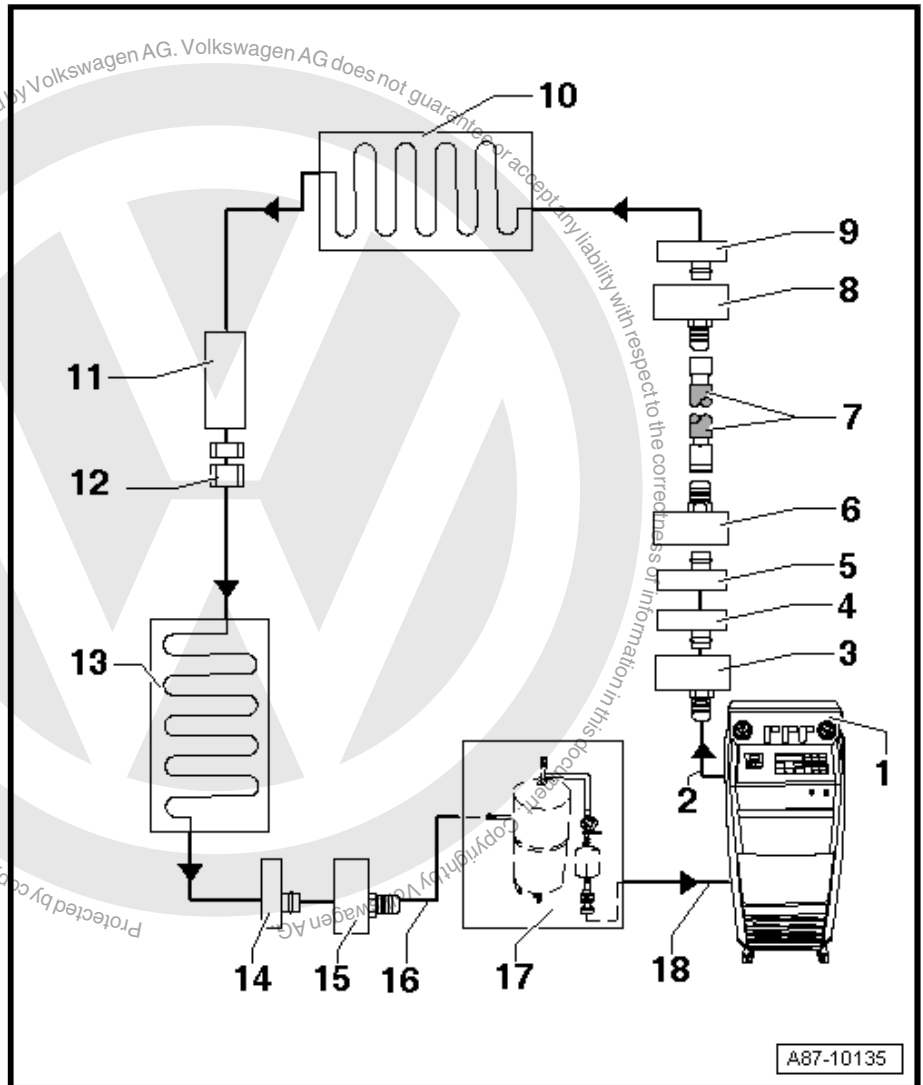
- ❑ Different versions depending on vehicle  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

- ❑ The item to be used between the refrigerant hose -2- and adapter -3- is adapter - VAS 6338/48- .
- ❑ From adapter case VW/Audi passenger vehicle set



### Note

- ◆ The charge hose of the air conditioner service station has an M12 x 1.5-6G external thread in accordance with SAE J639. Located on the adapter for connection of the low pressure side is a 5/8 -18 UNF external thread. To ensure that both components can be connected to each other, an additional adapter is required ⇒ Electronic parts catalogue .
- ◆ To attain the fastest flow speed possible, the service coupling is removed from the charge hose for purposes of flushing (bottle-necks are present in the service coupling that would significantly reduce the flow speed).





#### 4 - Connection of low pressure side in refrigerant circuit

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ☐ On refrigerant line from air conditioner compressor to reservoir

#### 5 - Connection to reservoir

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ☐ On refrigerant line from air conditioner compressor to reservoir

#### 6 - Adapter for bridging removed reservoir

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ☐ From adapter case VW/Audi passenger vehicle set

#### 7 - Charge hose for refrigerant

- ☐ For example charge hose from adapter case VW/Audi for passenger vehicles  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

#### 8 - Adapter for bridging removed reservoir

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ☐ From adapter case VW/Audi passenger vehicle set

#### 9 - Connection to reservoir

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

#### 10 - Evaporator

#### 11 - Location of restrictor

- ☐ The restrictor is removed.
- ☐ Remove restrictor ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).

#### 12 - Threaded connection in refrigerant line

- ☐ Screw back together following removal of the restrictor ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).

#### 13 - Condenser

#### 14 - Connection for high pressure side on refrigerant circuit

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)

#### 15 - Adapter for connection of high pressure side in refrigerant circuit

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ☐ From adapter case VW/Audi passenger vehicle set

#### 16 - Charging hose of flushing device for refrigerant circuits

- ☐ From connection to high pressure side of air conditioner compressor on refrigerant circuit (smaller diameter) to inlet of flushing device for refrigerant circuits.

#### 17 - Flushing device for refrigerant circuits

- ☐ Different versions and different design of flushing devices for refrigerant circuits ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning/heating)
- ☐ With filter, sight glass, safety valve, heating, refrigerant tank, etc. (depending on version).
- ☐ Depending on the design of the air conditioner service station and the flushing device for refrigerant circuits, there may be a non-return valve installed at the outlet of the flushing device for refrigerant circuits (to assure the correct direction of refrigerant flow during flushing).
- ☐ Depending on the layout of the flushing device for refrigerant circuits, there may be a connection for a service coupling for refrigerant circuits at the outlet and possibly the inlet of the flushing device (instead of a 5/8-18 UNF external thread). If a service connection with a valve is installed at the outlet of the flushing device, this valve must be opened completely when the service coupling is connected (an incompletely opened valve represents a bottle-neck). If a connection for a service coupling is present at the inlet of the flushing device, the inlet must be converted in such a way that the refrigerant hose coming from the vehicle can be connected directly (a service coupling and a valve in the inlet of the flushing device represent a bottle-neck that can hinder the flow of refrigerant out of the vehicle into the flushing device and thereby affect the flushing process).



## 18 - Refrigerant hose of air conditioner service station

- ☐ From the low pressure side of the air conditioner service station (normally coloured blue) to the outlet of the flushing device for refrigerant circuits.

### 1.6.6 Principle circuit diagrams for cleaning (flushing circuits) - vehicles with high-voltage system (without auxiliary air conditioning functions)



#### Note

- ◆ *The refrigerant circuit is cleaned in 2 flushing cycles (first the section with the evaporator in the front heating and air conditioning unit and then the section with the heat exchanger for high-voltage battery or evaporator in the battery cooling module) ⇒ [page 105](#)*
- ◆ *On vehicles with 2 evaporators or an evaporator and heat exchanger, separate the circuit to the second evaporator or the heat exchanger from the circuit of the first evaporator via hand shut-off valves, and flush it in a separate work step ⇒ [page 105](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *The layout of the various flushing circuits for these vehicles is similar to that on a vehicle with 2 evaporators.*

### 1.6.7 Adapters for setting up flushing circuits

- The desiccant bag and the desiccant cartridge must always be removed before any flushing routine. Then close the receiver again.
- On condensers with a permanent dryer, this can be flushed along with the other components. A new condenser must then be installed.



#### Note

*If a flushed refrigerant circuit is not reassembled immediately after flushing, the adapters must be left on the connections. These as well as components that are still open must be sealed with clean bungs from engine bung set - VAS 6122- .*

**On successful completion of flushing procedure, remove all adapters and renew following components during assembly**

- ◆ Air conditioner compressor (only after renewal of air conditioner compressor due to internal damage)
- ◆ Restrictor and expansion valve
- ◆ Desiccant bag and desiccant cartridge
- ◆ Evacuating and charging valve, high-pressure side and low-pressure side
- ◆ Oil seals

#### Passenger cars

Assembling flushing circuit	
Arteon 2018 ➤	⇒ <a href="#">page 107</a>



Assembling flushing circuit	
Atlas 2017 ►	⇒ <a href="#">page 107</a>
CC 2012 ►	⇒ <a href="#">page 107</a>
e-Golf 2014 ►	⇒ <a href="#">page 108</a>
e-Golf 2014 ► with heat pump	⇒ <a href="#">page 108</a>
Golf 2013 ►, Golf Estate 2014 ►	⇒ <a href="#">page 108</a>
Golf 2015 ►, Golf Estate 2015 ►	⇒ <a href="#">page 108</a>
Golf MEX 2018 ►	⇒ <a href="#">page 109</a>
Golf Estate MEX 2018 ►	⇒ <a href="#">page 109</a>
Golf GTE	⇒ <a href="#">page 109</a>
Golf Cabriolet 2012 ►	⇒ <a href="#">page 109</a>
Golf SV 2015 ►	⇒ <a href="#">page 108</a>
Jetta 2015 ►	⇒ <a href="#">page 112</a>
Jetta 2018 ►	⇒ <a href="#">page 112</a>
Passat 2015 ►, Passat Estate 2015 ►	⇒ <a href="#">page 109</a>
Passat 2018 ►, Passat Estate 2018 ►	⇒ <a href="#">page 109</a>
Passat GTE	⇒ <a href="#">page 109</a>
Passat (NMS-US) 2016 ►	⇒ <a href="#">page 110</a>
Polo 2014 ►	⇒ <a href="#">page 110</a>
Polo 2018 ►	⇒ <a href="#">page 110</a>
Scirocco 2015 ►	⇒ <a href="#">page 109</a>
Sharan 2016 ►	⇒ <a href="#">page 111</a>
T-Cross 2019 ►	⇒ <a href="#">page 111</a>
T-Roc 2018 ►	⇒ <a href="#">page 111</a>
The Beetle 2017 ►, The Beetle Cabriolet 2017 ►	⇒ <a href="#">page 112</a>
Tiguan 2016 ►, Tiguan MEX 2017 ►	⇒ <a href="#">page 111</a>
Touareg 2015 ►	⇒ <a href="#">page 112</a>
Touareg 2018 ►	⇒ <a href="#">page 112</a>
Touran 2016 ►	⇒ <a href="#">page 108</a>
up! 2017 ►	⇒ <a href="#">page 112</a>
e-up! 2017 ►	⇒ <a href="#">page 112</a>

**Commercial vehicles** ⇒ [page 106](#)



#### Note

*For a detailed description of assembling the flushing circuit, refer to the workshop manual ⇒ Air conditioning system with refrigerant R134a; Rep. gr. 00; Cleaning refrigerant circuit, commercial vehicles.*

Assembling flushing circuit	
Caddy 2016 ►	⇒ <a href="#">page 113</a>
Crafter 2017 or MAN TGE ►	⇒ <a href="#">page 113</a>
Transporter 2016 ►	⇒ <a href="#">page 114</a>





## Passenger cars

### Arteon 2018 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

### Atlas 2017 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Sealing adapter and flushing adapter for vehicles with second evaporator
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p> <p>◆ Rear refrigerant circuit Drilled out expansion valve ⇒ <a href="#">page 95</a></p>	<p>Low-pressure side of front refrigerant circuit</p> <p>◆ Sealing adapter - VAS 6338/63-</p> <p>High-pressure side of front refrigerant circuit</p> <p>◆ Sealing adapter - VAS 6338/5-</p> <p>Low-pressure side to second evaporator</p> <p>◆ Adapter - VAS 6338/3-</p> <p>High-pressure side to second evaporator</p> <p>◆ Adapter - VAS 6338/60-</p>

### CC 2012 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/18-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>





## e-Golf 2014 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/12-</li> </ul> <p>High-pressure side</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/3-</li> </ul> <p>Electrical air conditioner compressor</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/40- and adapter - VAS 6338/41-</li> </ul> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/38-</li> </ul> <p>Or</p> <ul style="list-style-type: none"> <li>♦ Drilled out expansion valve ⇒ <a href="#">page 95</a></li> </ul>

## e-Golf 2014 ► with heat pump

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Other adapters	Miscellaneous
<p>Low-pressure side</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/12- connected to air conditioner service station and adapter - VAS 6338/48- .</li> </ul> <p>High-pressure side</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/3-</li> </ul> <p>Purging electrical air conditioner compressor</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/40- and adapter - VAS 6338/41-</li> </ul> <p>Adapter - VAS 6338/48- to air conditioner service station Observe notes: ⇒ <a href="#">page 149</a></p>	<p>Install adapter - VAS 6338/38- in place of expansion valve (or a drilled out expansion valve ⇒ <a href="#">page 95</a> )</p> <p>After flushing, install a new expansion valve.</p>	<p>Bridge removed refrigerant lines on condenser</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/6- , qty. 2</li> <li>♦ Hose - VAS 6338/31-</li> </ul> <p>After purging, install a new reservoir (dryer).</p>	<p>Start "Basic setting" in ⇒ Vehicle diagnostic tester, and start the function "Charge refrigerant circuit".</p> <ul style="list-style-type: none"> <li>♦ This will open the electrical valves in the refrigerant circuit.</li> <li>♦ The function is active and must not be terminated until purging of the refrigerant circuit has been completed.</li> <li>♦ Leave ⇒ Vehicle diagnostic tester connected to keep the valves open.</li> </ul>

## Golf 2013 ►, Golf 2015 ►, Golf Estate 2014 ►, Golf Estate 2015 ►, Golf SV 2015 ►, Touran 2016 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/12-</li> </ul> <p>High-pressure side</p> <ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/3-</li> </ul> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<ul style="list-style-type: none"> <li>♦ Adapter - VAS 6338/18- or adapter - VAS 6338/38-</li> </ul> <p>Or</p> <ul style="list-style-type: none"> <li>♦ Drilled out expansion valve ⇒ <a href="#">page 95</a></li> </ul>



# **Golf MEX 2018 ► and Golf Estate MEX 2018 ►**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/18- or adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

# **Golf GTE, Passat GTE**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Other adapters
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- to air conditioner service station (electrical air conditioner compressor)</p> <p>◆ Adapter - VAS 6338/40- and adapter - VAS 6338/41-</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>	<p>Renew shut-off valves -N541- and -N542-</p> <p>◆ Shut-off tap - VAS 6338/42- qty. 2</p> <p>Remove restrictor in refrigerant line to heat exchanger for high-voltage battery and drill it out</p>

# **Golf Cabriolet 2012 ►, Scirocco 2015 ►**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/18-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

# **Passat 2015 ►, Passat Estate 2015 ►, Passat 2018 ►, Passat Estate 2018 ►**



## **Note**

*In the Passat 2015 and Passat Estate 2015 with bi-turbo engine, the refrigerant circuit is not flushed. In these vehicles, it would require too much effort to remove the expansion valve. If the air conditioner compressor is defective, check whether swarf has entered the condenser or whether there is swarf in the condenser outlet. If there is only swarf on the inlet side but not on the outlet side, renew only the condenser and the air conditioner compressor.*



Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/18- or adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

#### Passat (NMS-US) 2016 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/18- or adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

#### Polo 2014 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3- or adapter - VAS 6338/2-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/39-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

#### Polo 2018 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>



#### Sharan 2016 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Sealing adapter and flushing adapter for vehicles with second evaporator
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>Front refrigerant circuit</p> <p>◆ Adapter - VAS 6338/18-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p> <p>Rear refrigerant circuit</p> <p>◆ Adapter - VAS 6338/33-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>	<p>Low-pressure side of front refrigerant circuit</p> <p>◆ Sealing adapter - VAS 6338/11-</p> <p>High-pressure side of front refrigerant circuit</p> <p>◆ Sealing adapter - VAS 6338/5-</p> <p>Low-pressure side to second evaporator</p> <p>◆ Adapter - VAS 6338/3-</p> <p>High-pressure side to second evaporator</p> <p>◆ Adapter - VAS 6338/4-</p>

#### T-Cross 2019 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

#### T-Roc 2018 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

#### Tiguan 2016 ► , Tiguan MEX 2017 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

**Touareg 2015 ►**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Sealing adapter and flushing adapter for vehicles with second evaporator
Low-pressure side ♦ Adapter - VAS 6338/12- High-pressure side ♦ Adapter - VAS 6338/2- or adapter - VAS 6338/3- Adapter - VAS 6338/48- to air conditioner service station (electrical air conditioner compressor) ♦ Adapter - VAS 6338/40- and adapter - VAS 6338/41-	♦ Adapter - VAS 6338/17- or adapter - VAS 6338/33- Or ♦ Drilled out expansion valve ⇒ <a href="#">page 95</a>	Low-pressure side of front refrigerant circuit ♦ Sealing adapter - VAS 6338/11- High-pressure side of front refrigerant circuit ♦ Sealing adapter - VAS 6338/5- Low-pressure side to second evaporator ♦ Adapter - VAS 6338/3- High-pressure side to second evaporator ♦ Adapter - VAS 6338/4-

**Touareg 2018 ►**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
Low-pressure side ♦ Adapter - VAS 6338/12- High-pressure side ♦ Adapter - VAS 6338/3-	♦ Adapter - VAS 6338/44- Or ♦ Drilled out expansion valve ⇒ <a href="#">page 95</a>

**up! 2017 ►, e-up! 2017 ►**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
Low-pressure side ♦ Adapter - VAS 6338/12- High-pressure side ♦ Adapter - VAS 6338/3- Adapter - VAS 6338/48- to air conditioner service station (electrical air conditioner compressor) ♦ Adapter - VAS 6338/40- and adapter - VAS 6338/41-	♦ Adapter - VAS 6338/34- or adapter - VAS 6338/36- Or ♦ Drilled out expansion valve ⇒ <a href="#">page 95</a>

**Jetta 2015 ►, The Beetle 2017 ►, The Beetle Cabriolet 2017 ►**

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
Low-pressure side ♦ Adapter - VAS 6338/12- High-pressure side ♦ Adapter - VAS 6338/3- Adapter - VAS 6338/48- for air conditioner service station	♦ Adapter - VAS 6338/18- or adapter - VAS 6338/38- Or ♦ Drilled out expansion valve ⇒ <a href="#">page 95</a>



## Commercial vehicles



### Note

For a detailed description of assembling the flushing circuit, refer to the workshop manual → Air conditioning system with refrigerant R134a; Rep. gr. 00 ; Cleaning refrigerant circuit, commercial vehicles .

### Caddy 2016 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/18-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>

### Crafter 2017 or MAN TGE ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Sealing adapter and flushing adapter for vehicles with second evaporator
<p>Low-pressure side</p> <p>◆ Adapter - VAS 6338/12-</p> <p>High-pressure side</p> <p>◆ Adapter - VAS 6338/3-</p> <p>Adapter - VAS 6338/48- for air conditioner service station</p>	<p>◆ Adapter - VAS 6338/38-</p> <p>Or</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p> <p>Rear refrigerant circuit</p> <p>◆ Drilled out expansion valve ⇒ <a href="#">page 95</a></p>	<p>Low-pressure side of front refrigerant circuit</p> <p>◆ Sealing adapter - VAS 6338/5-</p> <p>High-pressure side of front refrigerant circuit</p> <p>◆ Sealing adapter - VAS 6338/63-</p> <p>Low-pressure side to second evaporator</p> <p>◆ Adapter - VAS 6338/3-</p> <p>High-pressure side to second evaporator</p> <p>◆ Adapter - VAS 6338/60-</p>





## Transporter 2016 ►

Flushing adapter refrigerant lines to air conditioner compressor	Flushing adapter expansion valve	Sealing adapter and flushing adapter for vehicles with second evaporator
Low-pressure side ♦ Adapter - VAS 6338/12- High-pressure side ♦ Adapter - VAS 6338/3- Adapter - VAS 6338/48- for air conditioner service station	♦ Adapter - VAS 6338/56- Or ♦ Drilled out expansion valve ⇒ <a href="#">page 95</a> ♦ Rear refrigerant circuit ♦ Drilled out expansion valve ⇒ <a href="#">page 95</a>	Low-pressure side of front refrigerant circuit ♦ Sealing adapter - VAS 6338/62- ♦ Connecting adapter angle piece - VAS 6338/64- High-pressure side of front refrigerant circuit ♦ Sealing adapter - VAS 6338/63- Low-pressure side to second evaporator ♦ Adapter - VAS 6338/61- High-pressure side to second evaporator ♦ Adapter - VAS 6338/60- On vehicles with 1 evaporator system, flush once On vehicles with 2nd evaporator system, flush twice

### 1.6.8 General information about blowing through with compressed air or nitrogen

In order to remove moisture and other contaminants as well as old refrigerant oil from the refrigerant circuit as cleanly as possible, without wasting the refrigerant and in an uncomplicated and environmentally compatible way, the refrigerant circuit must be cleaned with refrigerant R1234yf (flushed with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .

Blowing through the refrigerant circuit with compressed air and nitrogen is a method to be applied e.g. only if individual components are to be cleaned.



#### Note

- ◆ *The refrigerant circuit should then only be blown through with compressed air and then with nitrogen if there are no means of flushing the refrigerant circuit, or the amount of work necessary to flush individual components would be too great (removed refrigerant lines can also be blown through, for example, to remove low level contaminants and moisture without taking much time).*
- ◆ *The method of blowing through the whole refrigerant circuit with compressed air and nitrogen often requires a lot more work than cleaning (flushing) with refrigerant R1234yf. When flushing with refrigerant R1234yf, cleaning of the components is also far more efficient. It is therefore always best to flush the system in the event of complaints (the method of blowing through should only be selected for certain complaints and for individual components).*
- ◆ *Under certain circumstances it may be sufficient, for example, to blow through selected components (e.g. individual refrigerant lines or refrigerant hoses) with compressed air (e.g. to force out old refrigerant oil from individual removed components) or nitrogen (to dry individual components).*
- ◆ *Certain contaminants are difficult or impossible to remove from the refrigerant circuit with compressed air. These contaminants can be removed, for example, by cleaning (flushing) with refrigerant R1234yf  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .*
- ◆ *When blowing through (with compressed air or nitrogen), the maximum working pressure should not exceed 15 bar (equates to the pressure in a filled refrigerant circuit with an ambient temperature of approx. 60°C, if necessary use pressure limiter for compressed air as well).*
- ◆ *If during the gas analysis it is found that R1234yf refrigerant has been contaminated with a different gas, it must be extracted from the refrigerant circuit and disposed of as a gas of unknown composition in accordance with the relevant legislation ⇒ VW / Audi-ServiceNet and ⇒ [page 155](#) .*
- ◆ *Contaminated refrigerant can cause decomposition products to form and accumulate in the refrigerant circuit. These cannot be extracted with the refrigerant. The contaminated refrigerant oil, in this case, must be removed from the refrigerant circuit by flushing with refrigerant  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .*
- ◆ *If there is no suitable air conditioner service station available for the R1234yf refrigerant, the air conditioner service station designed for R134a refrigerant may also be used and the refrigerant circuit may also be flushed with R134a refrigerant. Using R134a refrigerant to clean the refrigerant circuit is currently permissible ⇒ Air conditioning system with R134a refrigerant; Rep. gr. 87 ; Refrigerant circuit; Flushing (cleaning) refrigerant circuit with R134a refrigerant .*



#### CAUTION

Risk of injury from nitrogen escaping under high pressure.

- Use pressure limiter for nitrogen tank.

- Always clean components against the direction of refrigerant flow (flush with R1234yf refrigerant) or blow through.



- Extract the mixture of refrigerant, refrigerant oil, compressed air or nitrogen escaping out of the components with an extraction system.



#### Note

*Compressed air and nitrogen cannot be blown through the restrictor, expansion valve, air conditioner compressor, receiver or reservoir.*

- In cases where condensers have a drying agent cartridge in the integrated receiver, this drying agent cartridge must be removed.



#### Note

♦ *With condensers in which the receiver / desiccant cartridge are integrated and cannot be renewed individually, the condenser is to be renewed after cleaning (flushing).*

♦ *Depending on the version, receivers - in which the desiccant cartridge is to be renewed individually - may feature an additional filter element, which will need to be renewed with the desiccant cartridge if necessary.*

- First blow out old refrigerant oil and contaminants with compressed air, then blow out components with nitrogen (clean, blow out or dehumidify old refrigerant oil).
- Adapter for connecting pressure hose to refrigerant circuit  
Adapter case for VW/Audi passenger vehicles ⇒ Electronic parts catalogue .

To prevent oil and moisture from the compressed air system making its way into the refrigerant circuit, the following points must be observed.

- ♦ The compressed air must be fed through a compressed air cleaning unit to clean and dry it. Therefore, use a filter and dryer for compressed air (included in the supply of tools for paint systems) ⇒ Electronic parts catalogue .
- ♦ On refrigerant lines with threads or union nuts on the connection, use adapter from refrigerant circuit adapter set - V.A.G 1785- ( adapter - V.A.G 1785/1- to adapter - V.A.G 1785/8- ) to connect the 5/8" - 18 UNF charges hose (one part of this adapter is also included in the adapter case for VW/Audi passenger vehicles ).
- ♦ On refrigerant lines without thread or union nut on the connection (for connection of adapters), use adapter from adapter case VW/Audi passenger vehicle set or proprietary air blow gun with rubber nozzle.



#### Note

*Always extract any escaping air and/or nitrogen from the components using appropriate local exhaust ventilation LEV (e.g. workshop extraction system).*

**The refrigerant circuit (or individual components) must be blown through if there are no means of flushing or flushing does not appear to be the appropriate solution.**

- if there is dirt or contamination in individual components of the refrigerant circuit.



- The search for faults in the electrical system, the vacuum system and the air ducts did not turn up any fault. (Moisture is in the refrigerant circuit and builds up pressure.)
- If the refrigerant circuit has been left open for longer than normally required for repairs (e.g. following an accident).
- Pressure and temperature measurements in the circuit indicate that there is moisture in the refrigerant circuit.
- The vehicle-specific workshop manual deems it necessary after replacement of certain components ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit, System overview - refrigerant circuit .



#### Note

*Certain contaminants and old refrigerant oil are difficult or impossible to remove from the refrigerant circuit with compressed air or nitrogen. These contaminants can be removed, for example, by flushing with refrigerant R1234yf*

⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .

- ◆ Blow through refrigerant circuit with compressed air or nitrogen

⇒ [“1.6.9 Blowing through refrigerant circuit with compressed air or nitrogen”, page 118](#)



## 1.6.9 Blowing through refrigerant circuit with compressed air or nitrogen



### Note

- ◆ *Vehicles with refrigerant lines that do not have a thread on which to connect adapter - 1785- require e.g. a compressed air gun with rubber nozzle or an adapter from adapter case for VW/Audi passenger vehicles to blow out individual components. When using a compressed air gun with rubber nozzle, be particularly careful not to damage the connections (do not crush or scratch them).*
- ◆ *The evaporator should be blown through from the connection to the low pressure side (large diameter), with the expansion valve or restrictor removed.*
- ◆ *Always blow out components against the direction of refrigerant flow (or flush with R1234yf refrigerant).*
- ◆ *Examine the expansion valve; renew if dirty or corroded.*
- ◆ *If there are dark sticky deposits in the components, and these cannot be removed with compressed air, flush these components with refrigerant R1234yf or renew.*
- ◆ *Thin, light grey deposits on the insides of pipes do not impair the function of the components.*
- ◆ *After blowing out, renew the receiver (desiccant cartridge) or reservoir and restrictor. In cases where condensers have a drying agent cartridge in the integrated receiver, this drying agent cartridge must be renewed.*
- ◆ *On vehicles having condensers with an integrated receiver/desiccant cartridge which cannot be renewed separately or which are not available as a replacement part, the condenser must be renewed after flushing the refrigerant circuit ⇒ *Electronic parts catalogue* and ⇒ *Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).**
- ◆ *Depending on the version, receivers - in which the desiccant cartridge is to be renewed individually - may feature an additional filter element, which will need to be renewed with the desiccant cartridge if necessary.*

### After blowing out the refrigerant circuit:

- Renew these vehicle-specific components (restrictor and reservoir, expansion valve and receiver / dryer cartridge) ⇒ *Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual)* and ⇒ *Electronic parts catalogue*
- Depending on complaint, renew air conditioner compressor ⇒ *Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual)* and ⇒ *Electronic parts catalogue* or drain remaining refrigerant oil from removed air conditioner compressor ⇒ ["1.5 Renewing components", page 78](#) and refill with requisite amount of fresh refrigerant oil ⇒ *Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual)* and ⇒ *Heating, air conditioning; Rep. gr. 00 ; Technical data; Refrigerant oil* .



## Note

- ◆ *Replacement compressors contain a certain specified quantity of refrigerant oil. On vehicles with two evaporators, a certain amount of refrigerant oil may also have to be filled in the circuit if necessary ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .*
- ◆ *If the air conditioner compressor does not need to be renewed, replenish the refrigerant oil accordingly up to the prescribed fill level (empty refrigerant oil and pour the prescribed volume back into the air conditioner compressor or refrigerant circuit) ⇒ [page 78](#) , ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; refrigerant oil .*
- Completely reassemble the refrigerant circuit again ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- Evacuate and charge the refrigerant circuit in the prescribed manner ⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) and ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Bring the air conditioning system into operation in the prescribed manner ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Bringing air conditioning system into operation after charging refrigerant circuit and ⇒ [“2.7 Bringing air conditioning system into service after charging”, page 143](#)







## 1.7 Checking pressures with pressure gauge

⇒ [“1.7.1 Display on pressure gauges”, page 120](#)

⇒ [“1.7.2 Pressure gauges enable the following test and measurement work”, page 120](#)

### 1.7.1 Display on pressure gauges

- 1 - Temperature scale for R1234yf refrigerant ( $\text{CF}_3\text{CF} = \text{CH}_2$ ) in °C
- 2 - Pressure scale in bar overpressure



#### Note

- ◆ *Pressure is indicated in various units: 1 MPa (Mega-Pascal) is equal to 10 bar or 145 psi; 1 bar absolute pressure is equal to 0 bar, which is about the same as ambient pressure (atmospheric pressure).*
- ◆ *This diagram shows a pressure gauge displaying pressure on the low pressure side. The display here is shown in bar overpressure (noticeable by “-1” in the display).*

In addition to the pressure scale, the pressure gauges can have one or more temperature scales. The scale values for R1234yf are assigned according to the vapour pressure table. Because different refrigerants have different vapour pressures at the same temperature, each temperature scale is labelled for the respective refrigerant.

- ◆ Pressure gauges enable the following testing and measuring measures  
⇒ [“1.7.2 Pressure gauges enable the following test and measurement work”, page 120](#) .



### 1.7.2 Pressure gauges enable the following test and measurement work

#### Pressure and temperature measurement in refrigerant circuit

- ◆ The high pressure gauge allows the pressure (and temperature) to be measured with the air conditioning system switched on irrespective of whether this is at the outlet of the air conditioner compressor through the condenser up to the restriction (restrictor or expansion valve).
- ◆ The low pressure gauge facilitates measurement of the pressure (and temperature) that spreads evenly from the restriction (restrictor or expansion valve) through the evaporator up to the inlet of the air conditioner compressor with the air conditioning system switched on.



#### Note

*The relationship between pressure and temperature shown on the pressure gauges is valid only where the refrigerant in the circuit is liquid or vapour, but not when it is gas. In the gaseous state, the temperature is approx. 10°C to 30°C higher than indicated on the pressure gauge.*

#### Evidence of refrigerant in a closed container

R1234yf refrigerant is present in a closed container or refrigerant circuit if the temperature indicated on the pressure gauge corre-



sponds to the temperature of the refrigerant (the temperature of a standing fluid stabilises at ambient temperature).

A closed container or isolated refrigerant circuit is empty if the temperature indicated on the pressure gauge is below the temperature of the refrigerant.



#### Note

- ◆ *The dependency between pressure and temperature described on the pressure gauges no longer applies when there is no liquid and the pressure is created by gas alone.*
- ◆ *Since the R1234yf and R134a refrigerant pressures are very close to each other over a broad temperature range, it is not possible to distinguish between them by means of the pressure measurement. It is possible to distinguish between them e.g. by means of a gas analysis  
⇒ ["6.2.16 Analysis of refrigerant R1234yf", page 24](#) .*







## 2 Working with air conditioner service station

⇒ [“2.1 Working with air conditioner service station”, page 123](#)

⇒ [“2.2 Connecting air conditioner service station to refrigerant circuit”, page 125](#)

⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#)

⇒ [“2.4 Emptying refrigerant circuit”, page 131](#)

⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#)

⇒ [“2.6 Charging refrigerant circuit”, page 140](#)

⇒ [“2.7 Bringing air conditioning system into service after charging”, page 143](#)

⇒ [“2.8 Switching off air conditioner service station and separating from refrigerant circuit”, page 145](#)

⇒ [“2.9 Charging refrigerant in reservoir”, page 147](#)

⇒ [“2.10 Emptying air conditioner service station”, page 148](#)

⇒ [“2.11 Cleaning electrical air conditioning compressor”, page 149](#)

⇒ [“2.12 Cleaning refrigerant circuit”, page 151](#)

⇒ [“2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal”, page 155](#)

⇒ [“2.14 Checking pressures”, page 164](#)

### 2.1 Working with air conditioner service station



#### Note

- ◆ *Should there be any reason to believe that chemical substances (leak stop additives) have been used to seal leaks in the refrigerant circuit from which refrigerant is to be extracted, do not connect the air conditioner service station to this refrigerant circuit and do not extract the refrigerant.*
- ◆ *Chemical substances used to seal leaks form deposits in the refrigerant circuit. These can impair the function of the air conditioning system and cause the air conditioning system (and your air conditioner service station) to fail.*
- ◆ *Bring the customer's attention to the presence of substances in the air conditioning system that are not approved by Volkswagen/Audi, which prevent the air conditioning system from being flushed and repaired.*
- ◆ *Volkswagen/Audi does not authorise the use of chemical substances (leak stop additives) for purposes of sealing leaks in refrigerant circuits. There are currently no long-term tests, effectiveness or material-compatibility tests. As such, there is no way of ruling out damage or malfunctions in an air conditioning system or air conditioner service station.*
- ◆ *The leak stop additives currently available on the market have different physical and chemical properties. These could impair the function of the air conditioning system and air conditioner service station with lasting effect or even cause a total failure. VW/Volkswagen/Audi does not endorse the use of chemical substances (leak inhibitor additives) for purposes of sealing leaks in refrigerant circuits.*



- ◆ *These chemical substances (leak stop additives) react mostly with the ambient air or the humidity to stop leaks in the refrigerant circuit. They cause deposits to build up in the refrigerant circuit (and your air conditioner service station), cause valves to malfunction and defects in other components with which they come into contact. These deposits cannot be completely removed from the components (not even by flushing).*
- ◆ *There are often no external signs to suggest that chemical substances (leak stop additives) have been used to seal leaks in a refrigerant circuit. Often, the stickers that are meant to be used to mark such systems are missing. Therefore, exercise caution on vehicles for which you have no service or repair record.*
- ◆ *Containers or tanks with integrated filters are offered as accessories on the open market that are designed to separate these chemical substances (leak stop additives for sealing leaks). Since Volkswagen/Audi is unaware of the composition and the physical and chemical properties of these substances, no statement can be made at this point as to the effectiveness and the filtering capability of these filters.*

If repair work needs to be carried out on the refrigerant circuit of the air conditioning system on a vehicle whose refrigerant circuit has been filled with chemical substances (leak stop additives) to seal leaking components (or there is good reason to believe that this has been the case), bring the client's (the vehicle owner's) attention to the following situation:

- ◆ The refrigerant of the air conditioning system cannot be extracted owing to the substances (leak stop additives) that it contains, which can damage your air conditioner service station. To extract the refrigerant, it can be filled in a recycling cylinder in the way described for contaminated refrigerant  
⇒ [“2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal”, page 155](#). Should this not be possible, it may be necessary e.g. for a company to be entrusted with extraction of the contaminated refrigerant using a suitable device. This should then be processed (or disposed of) e.g. by a local disposal company well versed in the procedures relating to the disposal of refrigerants.
- ◆ For proper repair of the air conditioning system, it is necessary to renew all components of the refrigerant circuit that have come into contact with the leak stop additive. The leak stop additive could already have damaged some components of the refrigerant circuit (e.g. the air conditioner compressor regulating valve - N280- ) or subsequently cause damage when the system is brought back into operation and, after a short time, failure of said components. Furthermore, deposits of leak stop additive in the components of the refrigerant circuit may work loose at a later stage, leading to renewed failure of the air conditioning system (completely cleaning these components using workshop equipment is currently not possible).
- ◆ Contaminated refrigerant can render the whole filling in your air conditioner service station unusable.
- ◆ Before extracting with a suitable tester, check the composition of the refrigerant in the refrigerant circuit  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#).
- ◆ Extract contaminated refrigerant into a recycling cylinder and send this in to your gas supplier for analysis, processing or disposal  
⇒ [“6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal”, page 25](#).



#### Note

- ◆ *Contaminated refrigerant can change the way in which the air conditioning system works and / or permanently damage components of the refrigerant circuit.*
- ◆ *Mixtures of different refrigerants (e.g. R1234yf refrigerant with an unknown quantity of R134a refrigerant) may not be filled in a vehicle that has been given type approval for R1234yf refrigerant.*

#### Important instructions for working with air conditioner service station

To operate the air conditioner service station ( air conditioner service station currently available ⇒ Workshop equipment and special tools catalogue ), the following must be observed:

- ◆ The fitted filter and dryer must be renewed at the latest when the operational time specified in the related operating instructions has been reached.
- ◆ If an air conditioner service station is also used to clean (flush) the refrigerant circuit, the dryer and filter installed in the system must be replaced at shorter intervals ⇒ [page 118](#) .
- ◆ Only refrigerant oils that are approved for the vehicle-specific refrigerant circuit may be filled in the reservoir (pour the refrigerant oil directly into the refrigerant circuit if necessary) ⇒ Electronic parts catalogue .
- ◆ Depending on the version of air conditioner service station and the measures to be performed, there is a minimum volume of refrigerant, refrigerant oil and UV leak detection additive that must be in the respective supply reservoirs of the air conditioner service station ⇒ Operating instructions air conditioner service station

In the event of any doubt regarding the composition of the refrigerant extracted from the refrigerant circuit, the extracted refrigerant must not be re-used even after it has been cleaned in the air conditioner service station

⇒ ["2.3 Performing gas analysis of refrigerant", page 128](#) .

- ◆ If the wrong refrigerant has been accidentally poured in the air conditioner service station , it must be emptied  
⇒ ["2.4 Emptying refrigerant circuit", page 131](#) and  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) . The system may also need to be cleaned, including renewal of the filters, dryers and refrigerant oil.
- ◆ Contaminated refrigerant, e.g. in Germany, can be returned to the supplier in so-called recycling cylinders for analysis, processing or environmentally-compatible disposal (in other countries, different or additional regulations may apply)  
⇒ ["6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal", page 25](#) .

## 2.2 Connecting air conditioner service station to refrigerant circuit

### Connecting

- Depending on the type of equipment chosen, there may be variations in the required procedure; therefore always follow the user's manual for the equipment being used.





## Note

*The procedure described in the instruction manual for your air conditioning service station is to be followed ⇒ Operating instructions air conditioner service station .*

The charging hoses must only be connected according to the following work procedure to prevent air or moisture from entering the refrigerant circuit:

- On vehicles with high-voltage system, switch off “stationary air conditioning” function (deactivate) ⇒ Owner's Manual and ⇒ Operating instructions of infotainment / MMI .
- Switch off ignition.
- Connect the air conditioner service station to the power supply.
- Switch on the air conditioner service station and bring it into operation as described in the instructions ⇒ Operating instructions air conditioner service station .
- Unscrew the sealing caps from the service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Evacuate the charge hoses if necessary.
- Check service connections of refrigerant circuit for contamination or corrosion, clean if necessary.



## Note

*Dirt or a rough surface on the service connections caused by corrosion can cause damage to the seals and thereby premature failure of the quick-release couplings.*

- Fit quick-release couplings to the service connections of the refrigerant circuit.



## NOTICE

**Risk of damage to the air conditioner compressor or air conditioner service station.**

**Opening the valves with the air conditioning system switched on can cause a short circuit between the high pressure and low pressure side.**

- **Never open valves on the high pressure or low pressure side with the air conditioning system switched on.**
- Turn the handwheel of the quick-release coupling adapter on the low pressure side no further than necessary to completely open the service connection (observe pressure gauge; do not over-tighten valve).
- Perform a gas analysis using the air conditioner service station (only necessary if refrigerant needs to be extracted or pressures in the refrigerant circuit need to be checked)  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#) .



#### Note

*Connect the gas analysis device or air conditioner service station to the refrigerant circuit as instructed to do so, and bring it into operation ⇒ Operating instructions of gas analysis device , ⇒ [page 125](#) and / or ⇒ Operating instructions air conditioner service station .*

If during the gas analysis it is found that the refrigerant in the circuit meets the specifications:

- Turn the handwheel of the quick-release coupling adapter on the high pressure side no further than necessary to completely open the service connection (observe pressure gauge; do not over-tighten valve).
- Perform the measures as required on the refrigerant circuit using the air conditioner service station .



#### Note

- ◆ *If, during the gas analysis, it is found that the R1234yf refrigerant is contaminated, extract the refrigerant from the refrigerant circuit and send it back e.g. to your gas supplier for processing (or disposal)  
⇒ [“2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal”, page 155](#) ,  
⇒ [“6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal”, page 25](#) and  
⇒ [“6.1 Basics of air conditioning technology”, page 16](#) .*
- ◆ *Should there be no means of doing this, extract the contaminated refrigerant immediately from the refrigerant circuit of the vehicle and collect in a recycling cylinder. Unscrew (close) the handwheel of the quick release coupling adapter on the low pressure side, switch off the air conditioner service station (and isolate from the power supply if necessary). Then separate the quick release coupling adapter on the low pressure side from the vehicle. The quick release coupling adapter on the low pressure side must then be separated - e.g. with a suction hose from the workshop extraction unit - from the charge hose for the air conditioner service station and the contaminated refrigerant allowed to flow out of the charge hose into the extraction hose of the workshop extraction unit. To restore operational readiness of the air conditioner service station , reinstall the quick release coupling adapter on the low pressure side on the charge hose for the air conditioner service station and evacuate using the air conditioner service station as instructed to do so in the relevant operating instructions ⇒ Operating instructions air conditioner service station .*
- Perform the measures as required using the air conditioner service station .
- ◆ ⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#)
- ◆ ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
- ◆ ⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) .
- ◆ ⇒ [“2.6 Charging refrigerant circuit”, page 140](#) .
- ◆ ⇒ [“2.8 Switching off air conditioner service station and separating from refrigerant circuit”, page 145](#)
- ◆ ⇒ [“2.9 Charging refrigerant in reservoir”, page 147](#) .
- ◆ ⇒ [“2.10 Emptying air conditioner service station”, page 148](#) .



- ◆ ⇒ ["2.14 Checking pressures", page 164](#)

## 2.3 Performing gas analysis of refrigerant



### Note

- ◆ *For operation of the air conditioning system, it is important that the refrigerant used has a certain degree of purity.*
- ◆ *Contamination with other refrigerants or gases can cause damage and thereby failure of the air conditioning system.*
- ◆ *Contaminated refrigerant must be returned as gas of unknown composition e.g. to your gas supplier for processing (or disposal) in accordance with legislative requirements ⇒ VW / Audi-ServiceNet .*
- ◆ *To prevent liquid components (e.g. droplets of refrigerant oil) in the extracted refrigerant gas from falsifying the result of the gas analysis, separators (filters) are installed in the gas analysis device that separate these droplets of liquid. Renew separators in accordance with specifications of gas analysis device or operating instructions of air conditioner service station ⇒ Operating instructions of gas analysis device or ⇒ Operating instructions of air conditioner service station .*

### All vehicles

- Connect the gas analysis device or air conditioner service station to the refrigerant circuit as instructed to do so, and bring it into operation ⇒ Operating instructions of gas analysis device ,  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) and / or ⇒ Operating instructions air conditioner service station .
- Perform the gas analysis as per the operating instructions.



### Note

- ◆ *A faulty gas analysis is possible from air in the refrigerant hoses or non-observance of the procedure for gas analysis as detailed in the operating instructions.*
- ◆ *Carefully follow the operating instructions of the gas analysis device / air conditioner service station .*
- ◆ *Evacuate refrigerant hoses of the air conditioner service station before connecting the service couplings to the refrigerant circuit/a natural gas fuel tank with refrigerant R1234yf (see operating instructions of the gas analysis device/the air conditioner service station )*  
⇒ ["2.3 Performing gas analysis of refrigerant", page 128](#) .

The gas analysis may provide the following results:

- ◆ The R1234yf refrigerant complies with the specifications, the planned measures may be performed with the air conditioner service station .
- ◆ A fault occurred during the gas analysis. The fault is to be investigated and rectified after which the gas analysis must be repeated.
- ◆ The analysed R1234yf refrigerant does not comply with the specifications, the analysed refrigerant must be extracted as refrigerant of unknown composition and returned e.g. to your gas supplier for processing (or disposal)



⇒ ["6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal", page 25](#)



#### Note

- ◆ *Should the analysis of the refrigerant - to be extracted e.g. from the refrigerant circuit of a vehicle - indicate that it is contaminated: you can also perform a gas analysis on the refrigerant e.g. of another cylinder from your gas supplier if you wish to verify the analysis result.*
- ◆ *Since the refrigerant R1234yf is so pure, even small residues of ambient air in the filler hoses of the air conditioner service station can falsify the results. For this reason, most air conditioner service stations have a feature via which the gas analysis is repeated up to 2 times before a not OK result is displayed ⇒ Operating manual for air conditioner service station .*
- ◆ *You can perform a simple function check on your gas analysis device e.g. using ambient air (unscrew the service coupling from the refrigerant hose with which the gas analysis is performed and analyse the gas with the refrigerant hose open). The result of this test should then indicate that the analysed gas is not OK.*
- ◆ *The method of gas analysis employed here was developed for motor vehicle workshops. It provides no details about the precise composition of the refrigerant. This gas analysis can therefore only show how high the percentage of R1234yf refrigerant is in the refrigerant analysed. If the percentage of R1234yf is below 95%, the refrigerant does not comply with the specifications and can cause damage to the components of the refrigerant circuit. A gas analysis that also provides details about the precise composition of the analysed refrigerant is currently not available for workshops. Gas analyses with which the precise composition of gases can be investigated require complicated equipment and procedures and can usually only be performed with dedicated testing facilities.*

**Should contaminated refrigerant be found during the gas analysis, notify the customer before continuing work and bring the customer's attention to the following:**

There is contaminated refrigerant or refrigerant of unknown composition in the refrigerant circuit of his vehicle that does not comply with the vehicle manufacturer's specifications. This refrigerant:

- ◆ must be returned e.g. to the gas supplier as refrigerant of unknown composition for analysis, processing (or disposal)  
⇒ ["6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal", page 25](#) .
- ◆ can be the cause of a malfunction or may already have caused damage that makes the inevitability of malfunctions in the near future probable.
- ◆ Depending on its composition, the use of contaminated refrigerant could lead to the operating permit of the vehicle being withdrawn.
- ◆ If, as a result of contaminated refrigerant, internal damage to the refrigerant circuit has been caused (e.g. decomposition products of the contaminated refrigerant have affected the components of the refrigerant circuit  
⇒ ["1.5 Renewing components", page 78](#) ), the refrigerant circuit can only be restored to full functionality once all components that came into contact with the contaminated refrigerant have been renewed. The internal condition of the refrigerant circuit can be appraised e.g. by visually inspecting certain



components of the refrigerant circuit (e.g. the condition of the internal surfaces of removed refrigerant lines and refrigerant hoses, the internal surface of the refrigerant reservoir and the condition of the removed dryer cartridge).

- ◆ If internal damage has been caused to the refrigerant circuit through contaminated refrigerant (e.g. failure of the air conditioner compressor has ensued owing to damaged control elements or overheating, refrigerant oil has a stronger colour than usual but the parts containing refrigerant have not been affected ⇒ ["1.5 Renewing components", page 78](#) ), the refrigerant circuit can be charged again once it has been flushed (renew air conditioner compressor, dryer and expansion valve). However, since there is no way of anticipating the long-term effect of the contaminated refrigerant on the refrigerant oil and the components of the refrigerant circuit, no guarantee can be given in this case that the components of the refrigerant circuit will function correctly in future.
- ◆ If the contaminated refrigerant has not caused internal damage to the refrigerant circuit (e.g. the refrigerant oil does not have a stronger colour than usual, the components of the refrigerant circuit have not been affected), the refrigerant circuit can be charged again once the dryer has been renewed and the refrigerant circuit has been evacuated for an extended period (at least 1 hour). However, since there is no way of anticipating the long-term effect of the contaminated refrigerant on the refrigerant oil and the components of the refrigerant circuit, no guarantee can be given in this case that the components of the refrigerant circuit will function correctly in future ⇒ ["1.5 Renewing components", page 78](#) .





#### Note

- ◆ *If there is a complaint that can be attributed to the contaminated refrigerant (e.g. leaking seals or hoses, damage to the air conditioner compressor, contaminated refrigerant oil), the refrigerant circuit must be flushed and then all components that were damaged by the contaminated refrigerant (seals, hoses, reservoir or dryer cartridge, expansion valve and air conditioner compressor) must be renewed. If it is found that the contaminated refrigerant has affected other components as well (e.g. the internal surfaces of the refrigerant pipes and refrigerant hoses, damaged seals), the complete refrigerant circuit must be renewed. The refrigerant circuit must then be recharged with clean refrigerant. Then check the function of the air conditioning system. For the customer and to safeguard yourself, make a note that the refrigerant circuit was charged with contaminated refrigerant.*
- ◆ *If there is a complaint that can be attributed to the contaminated refrigerant (e.g. loss or lack of cooling output) and no other complaints can be found in the refrigerant circuit, or if the refrigerant has to be extracted because work in the area of the refrigerant circuit so requires, proceed as follows after evacuating the system. Remove the dryer and check for contamination. Since there could also be refrigerant oil on or in the dryer, check this as well. If the refrigerant oil is contaminated, dark or viscous or if deposits of dirt have built-up on the dryer, flush the refrigerant circuit and renew the parts as described above (damage may already have been caused, which could soon lead to failure of the air conditioning system). If the refrigerant oil is OK and the dryer is not contaminated any more than is usual from normal operation, renew the dryer. Evacuate the refrigerant circuit for an extended period (at least 1 hour) and then recharge with clean refrigerant. Check the function of the air conditioning system. For the customer and to safeguard yourself, make a note that the refrigerant circuit was charged with contaminated refrigerant.*

## 2.4 Emptying refrigerant circuit

- Depending on the type of equipment chosen, there may be changes to the procedure (always follow user's manual for the equipment being used) ⇒ Operating instructions air conditioner service station .
- The refrigerant circuit should be emptied if parts of the refrigerant circuit are to be removed, if it is unclear whether there is refrigerant in the circuit, if contaminated refrigerant was determined during the gas analysis, or if safety precautions so demand.
- All of the operating instructions for work involving refrigerant with the air conditioner service station can be found in the operating instructions of the air conditioner service station ⇒ Operating instructions air conditioner service station .

### Draining

- On vehicles with high-voltage system, switch off “stationary air conditioning” function (deactivate)⇒ Owner's Manual .
- Switch off ignition.
- Connect the air conditioner service station to the power supply.

In addition for vehicles with electrically-actuated valves in the refrigerant circuit that are not open when unenergised:





## Note

*On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. To completely empty, correctly evacuate and charge the refrigerant circuit, however, no areas may be isolated. Therefore, these valves must be opened before these measures are carried out. The function is active and must not be terminated until the refrigerant circuit has been evacuated or filled using the air conditioner service station ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit and ⇒ Vehicle diagnostic tester in "Guided Functions" mode.*

- Using ⇒ Vehicle diagnostic tester, open any valves which are not open in their resting state.

## All vehicles

- Bring the air conditioner service station into operation as instructed in the associated operating manual.
- Unscrew the sealing caps from the service connections of the refrigerant circuit (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- Connect air conditioner service station to refrigerant circuit  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) .
- Perform a gas analysis with the air conditioner service station  
⇒ ["2.3 Performing gas analysis of refrigerant", page 128](#) .



## Note

- ◆ *If during the gas analysis it is found that the R1234yf refrigerant is contaminated, extract the refrigerant from the refrigerant circuit and send it e.g. back to your gas supplier for analysis, processing or disposal  
⇒ ["6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal", page 25](#) .*
- ◆ *Refill the refrigerant that is contaminated into a recycling cylinder and return it e.g. to your gas supplier for analysis, processing or disposal  
⇒ ["6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal", page 25](#) .*
- Evacuate the refrigerant circuit with the air conditioner service station as instructed in the associated operating manual.



## NOTICE

**Risk of damage to air conditioner compressor if refrigerant circuit is empty.**

- **Never start the engine if the refrigerant circuit is empty.**



## Note

- ◆ Sometimes, refrigerant oil is extracted from the refrigerant circuit along with the refrigerant and there is no way of stopping this. In order to ensure the lubrication of the air conditioner compressor, the refrigerant oil quantity should be topped up with fresh refrigerant oil  
⇒ [“2.6 Charging refrigerant circuit”, page 140](#) .
- ◆ Where vehicles are fitted with an air conditioner compressor without a magnetic clutch (with air conditioner compressor regulating valve - N280- ) the engine should be run with the refrigerant circuit empty for no longer than is absolutely necessary, making sure that higher engine speeds are avoided (since the air conditioner compressor will always run when the engine is running).
- ◆ On vehicles that have an air conditioner compressor without magnetic clutch, the engine may only be started with a completely assembled refrigerant circuit, ensuring that higher engine speeds are avoided.
- ◆ Depending on the version of air conditioner compressor, a valve may be installed on the high-pressure side that prevents liquefied refrigerant flowing back into the air conditioner compressor after the air conditioning system is switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit with expansion valve, it could take some time before the pressure on the high-pressure side drops (the expansion valve is cold and the pressure on the low-pressure side rises quickly after switching off, the expansion valve closes and refrigerant only flows slowly on the low-pressure side). If the air conditioner compressor is switched on (or the refrigerant circuit is emptied via the low pressure side), pressure on the low pressure side drops, the expansion valve opens and refrigerant can flow on the low pressure side.

If it is necessary after emptying to perform work on the vehicle for which the air conditioner service station is not required:

- Detach the air conditioner service station from the refrigerant circuit and switch off  
⇒ [“2.8 Switching off air conditioner service station and separating from refrigerant circuit”, page 145](#) .
- Open the refrigerant circuit at a connection point.



## CAUTION

**Risk of freezing injury caused by escaping pressurised refrigerant.**

**There is a risk of injury to the skin and parts of the body due to freezing.**

- Wear protective gloves.
- Wear protective goggles.
- Extract refrigerant and open the refrigerant circuit immediately afterwards.
- If more than 10 minutes have passed since the refrigerant was extracted, repeat the extraction process before opening the refrigerant circuit. Pressure could build up in the refrigerant circuit from continued evaporation.

- Perform the required measures on the refrigerant circuit.

If, after emptying, the refrigerant circuit is to be evacuated and recharged ⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) .



## Note

- ◆ *After opening the connecting points in the refrigerant circuit, the open lines and component connections must be closed (so that the ingress of moisture and dirt in these components is prevented).*
- ◆ *Sometimes, refrigerant oil is extracted from the refrigerant circuit along with the refrigerant and there is no way of stopping this. To ensure lubrication of the air conditioner compressor, the refrigerant oil quantity should be topped up with fresh oil.*
- ◆ *Where vehicles are fitted with an air conditioner compressor with air conditioner compressor regulating valve - N280- , the engine should be run with the refrigerant circuit empty for no longer than is absolutely necessary, making sure that higher engine speeds are avoided (since the air conditioner compressor will always run when the engine is running).*
- ◆ *On vehicles that have an air conditioner compressor with air conditioner compressor regulating valve - N280- , the engine may only be started with a completely assembled refrigerant circuit, ensuring that higher engine speeds are avoided.*

## 2.5 Evacuating refrigerant circuit

- The procedure described in the operating manual for your air conditioning service station is to be followed ⇒ Operating manual for air conditioner service station .
- The refrigerant oil volume in the air conditioner service station has been checked and, if necessary, adjusted ⇒ Operating instructions of air conditioner service station .
- The refrigerant volume in the air conditioner service station has been checked and, if necessary, adjusted ⇒ Operating manual of air conditioner service station .

Before the refrigerant circuit is filled with refrigerant, it must be evacuated, i.e. completely emptied of air. In the process, all moisture is drawn out of the circuit.

Leaks can be determined when evacuating the refrigerant circuit ⇒ ["1.4 Investigating leaks", page 67](#) .



### NOTICE

**Risk of damage to air conditioner compressor with negative pressure in the refrigerant circuit.**

- **Never start the engine if there is negative pressure in the refrigerant circuit.**

### Evacuating:

- The refrigerant circuit is completely assembled.
- On vehicles with high-voltage system, switch off stationary air conditioning function (deactivate) ⇒ **Owner's Manual** .
- Switch off ignition.
- Connect the air conditioner service station to the power supply.

In addition for vehicles with electrically-actuated valves in the refrigerant circuit that are not open when unenergised:



#### Note

- ◆ *On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. To empty completely, to evacuate correctly and to charge the refrigerant circuit, however, no areas may be isolated, which is why these valves must be opened before work is carried out ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *Non-return valves in the refrigerant circuit have a certain holding pressure in the direction of flow (approx. 0.1 bar or 100 mbar). To ensure that the refrigerant circuit can be evacuated completely (residual pressure below 5 mbar), all of the electrically actuated valves must therefore be open.*
- Use the vehicle diagnostic tester to open the electrically-actuated valves that are not open when unenergised ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

#### All vehicles

- Bring the air conditioner service station into operation as described in the instructions ⇒ Operating instructions air conditioner service station .
- Unscrew the sealing caps from the service connections of the refrigerant circuit (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check service connections of refrigerant circuit for contamination or corrosion, clean if necessary.



#### Note

*Dirt or a rough surface on the service connections caused by corrosion can cause damage to the seals and thereby premature failure of the quick-release couplings.*

- Connect the air conditioner service station to the refrigerant circuit  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) .
- Switch on the air conditioner service station , evacuate the refrigerant circuit and perform the vacuum test (for a period of e.g. 10 minutes with the vacuum pump on to remove any air, remains of refrigerant and moisture and 20 minutes for the vacuum/pressure increase check).



## Note

- ◆ *The vacuum at the end of the evacuating process (running of vacuum pump of air conditioner service station ) must be less than 5 mbar absolute pressure. Should pressure during the evacuating process in the refrigerant circuit not be less than 5 mbar, this could have various causes. For example, leaks in the refrigerant circuit or in the connection to the air conditioner service station , the time for the evacuating process is set too short, the vacuum pump of the air conditioner service station does not generate the necessary vacuum or the vacuum sensor of the air conditioner service station is not calibrated properly ⇒ Operating instructions air conditioner service station .*
- ◆ *An absolute pressure of 5 mbar equates to a vacuum of 975 mbar at an ambient pressure e.g. of 980 mbar.*
- ◆ *At the end of the vacuum/pressure increase check, pressure in the refrigerant circuit should not be greater than 20 mbar absolute. Should the pressure in the refrigerant circuit be greater than 20 mbar during the vacuum/pressure increase check, the vacuum pump is switched on and the process is repeated from the beginning ⇒ Operating instructions air conditioner service station . Should pressure in the refrigerant circuit still not be less than 20 mbar even after the process has been repeated twice, this could have various causes. For example, there could be leaks in the refrigerant circuit, a leak in the connection from the refrigerant circuit to the air conditioner service station or in the air conditioner service station itself, the time set for the evacuating process is too short and the time set for the vacuum/pressure increase check is too long.*
- ◆ *If there is reason to suspect a leak in the refrigerant circuit, switch off the air conditioner service station if necessary and allow it to stand for as long as possible (e.g. for at least 1 hour to check the leak-tightness of the refrigerant circuit) ⇒ Operating instructions air conditioner service station .*
- ◆ *Depending on the version of air conditioner service station , the pressure in the refrigerant circuit is displayed directly. However, there is also a chance that the current pressure is only displayed while the vacuum pump is running ⇒ Operating instructions air conditioner service station . In the event of an air conditioner service station only displaying the ambient pressure, the display of the pressure in the refrigerant circuit will depend on the ambient pressure during activation (ambient pressure at 980 mbar, a vacuum of 975 mbar equates to a residual pressure of 5 mbar absolute).*
- ◆ *If the refrigerant circuit was opened, small quantities of moisture may have entered the refrigerant circuit. In this case, the refrigerant circuit is to be evacuated for at least 30 minutes (pressure in the refrigerant circuit before charging must be less than 20 mbar).*
- ◆ *If the refrigerant was extracted (to check the fill volume) and the refrigerant circuit was only evacuated so that it could be recharged (the refrigerant circuit was not opened and is leak-tight), it is sufficient to evacuate the refrigerant circuit for 5 minutes and to set no time or only a short time (e.g. 1 minute) for the vacuum/pressure increase check (no air or moisture entered the refrigerant circuit).*





- ◆ Depending on the volume of refrigerant oil in the refrigerant circuit, the age and mileage of the vehicle, the layout of the refrigerant circuit etc., there is a chance with a leak-tight refrigerant circuit of the specified absolute pressure in the refrigerant circuit not rising above the prescribed 20 mbar owing to refrigerant evaporating out of the refrigerant oil. Should this be the case, repeat the process again if necessary and / or adapt the preset times accordingly.

If the vacuum display does not change (and the pressure stays below 20 mbar), the system is leak-tight and can be recharged.



#### Note

- ◆ Depending on the version of air conditioner service station, the current pressure in the refrigerant circuit is permanently displayed or only displayed after switching on e.g. the "Evacuate" function ⇒ Operating instructions air conditioner service station.

- ◆ Due to the high degree of evacuation, there is a chance that refrigerant - which evaporates from the refrigerant oil - could elevate the pressure in the refrigerant circuit during the vacuum test from 20 to 40 mbar (absolute pressure). This is no indication of a leak in the refrigerant circuit, though depending on the version of air conditioner service station it could trigger a fault. If necessary, evacuate the refrigerant circuit again and observe the vacuum display for an extended period. Only if the vacuum remains steady and you are certain that the refrigerant circuit is leak-tight is it permissible to charge the system.

- Charge the refrigerant circuit with air conditioner service station ⇒ ["2.6 Charging refrigerant circuit", page 140](#).

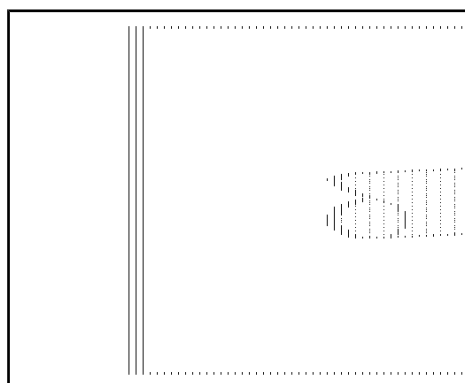
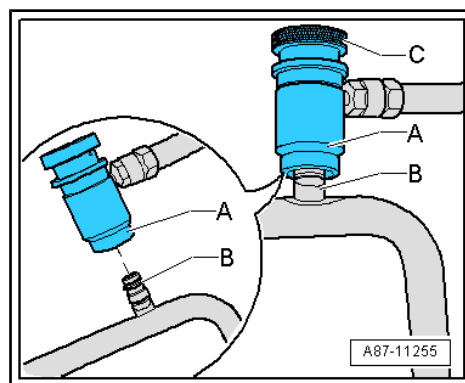
If the vacuum does not remain or sufficient pressure cannot be built-up, the following action is required:

- ◆ If pressure in the refrigerant circuit only rises slowly after evacuating e.g. owing to refrigerant (or moisture) evaporating from the refrigerant oil, evacuate the refrigerant circuit again and observe the vacuum gauge for an extended period.
- If there is any doubt as to whether the refrigerant circuit is actually leak-tight, evacuate again and observe the vacuum gauge for an extended period. Only when a vacuum is maintained can charging commence.
- Only if you are really sure that the refrigerant circuit is leak-tight should the system be charged  
⇒ ["2.6 Charging refrigerant circuit", page 140](#).

#### Further action if a leak is detected during evacuation:

- ◆ If there is a leak so major that it causes air to escape to such a degree during evacuation that the air conditioner service station is incapable of generating a sufficient vacuum or the vacuum gauge indicates immediately after switching off the air conditioner service station that air has entered the system and negative pressure is lost.
- Investigate the leak in the refrigerant circuit as follows:







## Note

- ◆ A larger leak in the refrigerant circuit can be detected, for example, by pressurising the circuit to a maximum of 15 bar using cleaned and dried compressed air or nitrogen ➔ [page 118](#) . If the leak is large enough, the leakage point can be detected by sound as the gas escapes.
- ◆ The compressed air or nitrogen is introduced to the closed, empty refrigerant circuit via the service connection -B- to which through a quick-release coupling adapter -A- has been connected.
- ◆ Screw the handwheel -C- into the quick-release coupling adapter -A- until the valve in the service connection -B- is completely open - do not over tighten the valve.
- ◆ The quick-release coupling adapter for service connection can be fitted e.g. with a modified charging hose -A- (for example with a M12 x 1.5-6G thread in accordance with SAE J639) depending on the thread of the quick-release coupling adapter and a suitable adapter -B- to connect to the workshop compressed air system ➔ [page 253](#) . To ensure that no moisture, oil and dirt from the workshop compressed air system enter the refrigerant circuit of the air conditioning system, use e.g. a combination fine filter unit for compressed air systems with an oil, dirt and water separator, which is commonly used in paint spraying facilities. Install this between the compressed air system and the charge hose -A- ➔ *Electronic parts catalogue* .
- ◆ Using the manifold gauge with pressure reducer for nitrogen (maximum reduced pressure: 15 bar) -1- you can connect a full nitrogen gas cylinder -3- via a charge hose -2- (e.g. with M12 x 1.5-6G thread in accordance with SAE J639) to the service connection - to which a quick-release coupling adapter is connected - of a closed, empty refrigerant circuit ➔ [page 252](#) .
- Slowly increase the pressure in the refrigerant circuit to a maximum of 15 bar.

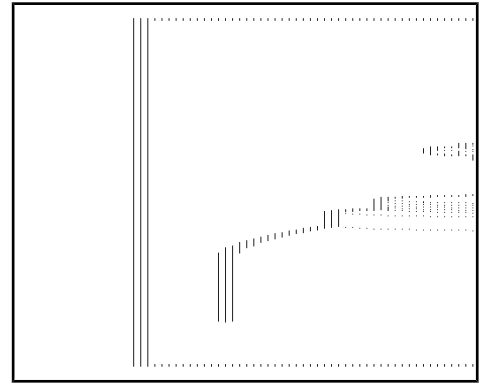


## CAUTION

**Risk of injury from nitrogen escaping under high pressure.**

- Use pressure limiter for nitrogen tank.

- Search for the leak by sound, which can be heard as gas escapes from this point.
- Repair the leak.
- Evacuate refrigerant circuit and observe the vacuum gauge over a period of hours. Only when a vacuum is maintained can charging commence.
- ◆ If a leak is present of a size where no or very little air is drawn in - with the refrigerant circuit evacuated - and the air conditioner service station can create sufficient vacuum. The vacuum gauge does not increase or increases very slowly after switching the air conditioner service station off. This indicates that there may be a very small ingress of air and the vacuum is lost.





- Charge the circuit with 100 g of refrigerant and search for the possible leak using an electronic leak tester  
⇒ [“1.4.2 Searching for leaks in refrigerant circuits using an electronic leak detector”, page 68](#) or add an approved UV contrast substance to the refrigerant and search for the possible leak in the circuit using the leak detector system  
⇒ [“1.4.3 Searching for leaks with UV leak detection system”, page 70](#) .
- Evacuate refrigerant circuit if necessary  
⇒ [“2.4 Emptying refrigerant circuit”, page 131](#)
- Rectify the problem in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Evacuate the refrigerant circuit and observe the vacuum gauge over an extended period. Only when a vacuum is maintained can charging commence  
⇒ [“2.5 Evacuating refrigerant circuit”, page 134](#) .

If it is necessary after evacuating to perform work on the vehicle for which the air conditioner service station is not required:

- Detach the air conditioner service station from the refrigerant circuit and switch off  
⇒ [“2.8 Switching off air conditioner service station and separating from refrigerant circuit”, page 145](#) .



#### NOTICE

**Risk of damage to air conditioner compressor with negative pressure in the refrigerant circuit.**

- **Never start the engine if there is negative pressure in the refrigerant circuit.**
- Ensure that, until the refrigerant circuit is charged, the engine cannot be started.

If after emptying and evacuating the refrigerant circuit is to be recharged ⇒ [“2.6 Charging refrigerant circuit”, page 140](#) .

## 2.6 Charging refrigerant circuit



#### Note

- ♦ *The whole amount of refrigerant can be charged either on the high pressure side or the low pressure side. Charging of the refrigerant circuit is described as follows for the high pressure side.*
- ♦ *Fill capacities of refrigerant and refrigerant oil ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .*
- The procedure described in the instruction manual for the air conditioning service station is to be followed ⇒ Operating instructions of air conditioner service station .
- Before charging the system with refrigerant, the amount of refrigerant oil must be adjusted ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .
- Ensure when charging the refrigerant circuit that the air conditioner service station is at the same level as the vehicle whose refrigerant circuit is to be charged (no greater than 50 cm difference). If the height difference is too great, deviations may occur between the amount of refrigerant displayed and the amount actually charged (depending on the version of air



conditioner service station ). The filling accuracy of the air conditioner service station may be affected.

- The refrigerant circuit is completely assembled ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .
- On vehicles with high-voltage system, switch off stationary air conditioning function (deactivate) ⇒ Owner's Manual .
- Switch off ignition.
- Connect the air conditioner service station to the power supply.
- Check the volume of refrigerant, the volume of refrigerant oil and the amount of UV leak detection additive in the air conditioner service station and replenish as necessary ⇒ Operating instructions air conditioner service station .

**In addition for vehicles with electrically-actuated valves in the refrigerant circuit that are not open when unenergised:**



#### Note

*On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. To empty the refrigerant circuit completely or to evacuate and charge it correctly, however, no areas must be isolated. Therefore, these valves must be opened before performing these types of work ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*

- Use the vehicle diagnostic tester to open the electrically-actuated valves that are not open when unenergised ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

#### All vehicles

- Bring the air conditioner service station into operation as described in the instructions ⇒ Operating instructions air conditioner service station .
- Unscrew the sealing caps from the service connections of the refrigerant circuit (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Connect quick-release couplings to the service connections of the refrigerant circuit  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) .
- Evacuate the refrigerant circuit with the air conditioner service station ⇒ ["2.5 Evacuating refrigerant circuit", page 134](#) .
- Adjust the requisite amount of refrigerant, the amount of refrigerant oil to be replenished if necessary and the amount of UV leak detection additive in the air conditioner service station ⇒ Operating instructions air conditioner service station , ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).
- Choose the relevant setting on the air conditioner service station for charging on the high pressure side ⇒ Operating instructions air conditioner service station .



When charging the refrigerant circuit on the low pressure side, liquefied refrigerant could accumulate in the compression chamber of the air conditioner compressor.

- Should it be necessary to charge the refrigerant circuit on the low pressure side, turn the air conditioner compressor 10 times by hand before bringing into operation for the first time after charging (if necessary, remove e.g. the drive belt to facilitate this).



#### Note

- ♦ *Refrigerant and refrigerant oil are charged in the refrigerant circuit on the high pressure side.*
- ♦ *If a vehicle has no service connection on the high pressure side of the refrigerant circuit, refrigerant can also be charged via the service connection on the low pressure side. To do this, however, always observe the setting and the operating instructions of the air conditioner service station .*
- ♦ *If on an air conditioner service station the charging device cannot be adjusted, unscrew (close) the handwheel on the quick-release coupling adapter on the low pressure side if necessary.*
- Charge the refrigerant circuit with the requisite amount of refrigerant, the amount of refrigerant oil that needs to be replenished if necessary, and the amount of UV leak detection additive.
- Bring the air conditioning system into operation after charging  
⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Bringing air conditioning system into operation after charging refrigerant circuit (vehicle-specific workshop manual) and  
⇒ [“2.7 Bringing air conditioning system into service after charging”, page 143](#)

#### Bringing air conditioning system with electrical air conditioning compressor into operation

- Bring the air conditioner compressor into operation via “Basic setting, compressor run-in” function in guided fault finding  
⇒ Vehicle diagnostic tester.

In addition for vehicles with electrically-actuated valves in the refrigerant circuit that are not open when unenergised:

- Use the vehicle diagnostic tester to enable (open or close) the electrically-actuated valves - that are not open when unenergised - for operation of the air conditioning system via the respective control unit ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.



#### Note

*On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. To completely empty, correctly evacuate and charge the refrigerant circuit, however, no areas may be isolated. Therefore, these valves must be opened before these measures are carried out. On completion of the work, enable actuation of these valves again via the respective control unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*

#### All vehicles

If it is necessary to perform a function check after charging the refrigerant circuit:

- Check the pressures in the refrigerant circuit ⇒ [page 164](#) .

If it is not necessary to perform a function check after charging the refrigerant circuit:

- Detach the air conditioner service station from the refrigerant circuit and switch off  
⇒ ["2.8 Switching off air conditioner service station and separating from refrigerant circuit", page 145](#) .

## 2.7 Bringing air conditioning system into service after charging



#### Note

- ◆ *If the mechanical air conditioner compressor was removed, turn it approx. 10 times by hand before initial operation (during installation or after installation e.g. before fitting the belt) so that no damage is caused from a fluid shock when it is switched on the first time (if there is refrigerant oil in the cylinder of the air conditioner compressor, this will be forced out by turning) ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .*
- ◆ *If the electrical air conditioner compressor was removed, before bringing the air conditioning system into operation for the first time and after charging, the air conditioner compressor is to be brought into operation via the "Basic setting, compressor run-in" function in guided fault finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation. This prevents damage to the air conditioner compressor, e.g. from a fluid shock, during initial activation (if there is refrigerant oil in the compression chamber of the air conditioner compressor, this will be forced out).*
- ◆ *The mechanical air conditioner compressor is driven by the engine via a belt or a shaft. The electrical air conditioner compressor is driven by an electric motor mounted directly on the air conditioner compressor (e.g. on vehicles with hybrid drive) ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor; Removing and installing air conditioner compressor .*





### Bringing air conditioning system with mechanical air conditioning compressor into operation

- Switch on ignition.
- Set the air conditioning system to the lowest output possible (e.g. select operating mode "A/C OFF").
- Switch off actuation of the air conditioner compressor (e.g. select operating mode "A/C OFF").
- Start the engine with the air conditioner compressor switched off (e.g. operating mode "A/C OFF" selected).
- Wait until idling speed has stabilised:
- Switch air conditioner compressor on and let system run for at least 2 minutes with engine idling.
- If necessary, check the pressures in the refrigerant circuit using the air conditioner service station ⇒ [page 123](#) .
- Switch off engine.
- Detach the air conditioner service station from the refrigerant circuit and switch off  
⇒ ["2.8 Switching off air conditioner service station and separating from refrigerant circuit", page 145](#) .

### Bringing air conditioning system with electrical air conditioning compressor into operation

- Switch on ignition.
- Bring the air conditioner compressor into operation via the "Basic settings, compressor run-in" function of guided fault finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.

In addition for vehicles with electrically-actuated valves in the refrigerant circuit that are not open when unenergised:

- Use the vehicle diagnostic tester to enable (open or close) the electrically-actuated valves - that are not open when unenergised - for operation of the air conditioning system via the respective control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.



#### Note

*On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. To completely empty, correctly evacuate and charge the refrigerant circuit, however, no areas may be isolated. Therefore, these valves must be opened before these measures are carried out. On completion of the work, enable actuation of these valves again via the respective control unit ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*

All air conditioning systems with electrical air conditioning compressor

- After the basic setting, check the pressures in the refrigerant circuit if necessary using the air conditioner service station .
- On vehicles with high-voltage system, switch off "stationary air conditioning" function (deactivate) ⇒ Owner's Manual .



- Switch off ignition.
- Detach the air conditioner service station from the refrigerant circuit and switch off  
⇒ [“2.8 Switching off air conditioner service station and separating from refrigerant circuit”, page 145](#).

#### Vehicles with electrical air conditioning compressor

- The engine may only be started when the refrigerant circuit has been fully assembled.
- On vehicles with battery cooling, hybrid operation is only possible with the air conditioning system charged and no faults stored in connection with the air conditioning system ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation.
- First bring the electrical air conditioner compressor into operation after installing the air conditioner compressor and charging the refrigerant circuit via the “Compressor run-in” function in basic settings. Should there be an accumulation of refrigerant oil in the compression chamber of the air conditioner compressor before installation owing to unfavourable storage, damage could be caused to the air conditioner compressor ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation.
- An electrically driven air conditioner compressor may only be activated when the refrigerant circuit is charged. Running the air conditioner compressor with the refrigerant circuit empty could lead to compressor damage ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation.
- To minimise the number of automatic engine starts when the vehicle's drive system is active (READY) during test and measurement work, charge the vehicle batteries e.g. with the battery charger 60 A - VAS 5904- in battery standby mode ⇒ Electrical system - General information; Rep. gr. 27 ; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .
- For test and measurement work that requires the vehicle's drive system to be active (READY) or the ignition to be switched on, move the selector lever to position “P”, activate the parking brake and arrange the tools needed so that they cannot come into contact with moving components of the engine and so that they cannot even come near to components that turn when the engine is running.

## 2.8 Switching off air conditioner service station and separating from refrigerant circuit

- Finish the requisite work with the air conditioner service station .
- Switch off ignition.
- Unscrew (close) the handwheels of both service couplings.



## CAUTION

**Risk of freezing injury caused by escaping pressurised refrigerant.**

**There is a risk of injury to the skin and parts of the body due to freezing.**

- Wear protective gloves.
- Wear protective goggles.
- If, when loosening the handwheel of the service coupling, refrigerant escapes from the refrigerant line for longer than 1 second, screw in the handwheel and renew the defective valve.
- Extract refrigerant and open the refrigerant circuit immediately afterwards.
- If more than 10 minutes have passed since the refrigerant was extracted, repeat the extraction process before opening the refrigerant circuit. Pressure could build up in the refrigerant circuit from continued evaporation.

### Different versions of service couplings

- ◆ On one version of service coupling, the space between the valve in the service connection of the refrigerant circuit and the valve in the service coupling is vented externally when the handwheel is unscrewed. On these service couplings, the valve in the service connection of the vehicle is closed first, followed by the valve in the service coupling for the charge hose of air conditioner service station when the handwheel of the service coupling is unscrewed. As it is unscrewed further, the pressure still present between the two valves is released via an additional valve (approx. 2 cm<sup>3</sup> of refrigerant). Should one of these two valves (the valve in the service connection of the vehicle or the valve in the service coupling for the charge hose) not close properly, the whole refrigerant could escape out of the refrigerant circuit of the vehicle or the charge hose.
- ◆ On another version of service coupling, the space between the valve in the service connection of the refrigerant circuit and the valve in the service coupling is not vented externally when the handwheel is unscrewed. This version features a valve that is open when the service coupling is connected, which facilitates pressure compensation between the space to the valve in the service connection of the refrigerant circuit and the charge hose connected to the service coupling. On this version, no refrigerant escapes when the handwheel of the service coupling is unscrewed, which is why the refrigerant has to be extracted from the filler hoses back into the air conditioner service station here before the service couplings are disconnected. If a large amount of refrigerant is recovered here, for example, after a pressure test or after charging the refrigerant circuit (more than approx. 50 g), this is an indication that a valve in one of the service connections of the refrigerant circuit could be leaking and refrigerant is escaping from the refrigerant circuit of the vehicle (extract refrigerant and renew the defective valve)

Before extracting the refrigerant from the charge hoses into the air conditioner service station, unscrew the handwheels of both service couplings as far as they will go.



#### Note

- ◆ *Stored in the air conditioner service station is a function via which it is switched to a specific operating mode when deactivated. The whole refrigerant is extracted from the charge hoses into the air conditioner service station with this function.*
- ◆ *If the handwheels of the two service couplings are not unscrewed when this function is activated, refrigerant could be extracted from the vehicle's refrigerant circuit.*
- Extract the refrigerant from the two filler hoses using the air conditioner service station as instructed in the relevant operating manual ⇒ Operating instructions of air conditioner service station .



#### Note

- ◆ *If, on an air conditioner service station with a service coupling that does not vent to the outside, this process takes longer than approx. 2 minutes or quite a large amount of refrigerant is extracted, this suggests that there is a fault in one of the valves in a service connection.*
- ◆ *If, on an air conditioner service station with a service coupling that does vent to the outside, this process takes longer than approx. 2 minutes, this suggests that there is a fault in one of the valves in a service coupling.*



#### Note

*Erroneous extraction from vehicle's refrigerant circuit.*

- First unscrew (close) the handwheels of the quick-release coupling adapters.
- Then extract the refrigerant from the two charge hoses using the air conditioner service station.
- Switch off the air conditioner service station (and isolate it from the power supply if necessary) ⇒ Operating instructions air conditioner service station .
- Separate the quick-release couplings from the service connections of the refrigerant circuit.
- Screw the sealing caps on the service connections (see vehicle-specific refrigerant circuit) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit .

## 2.9 Charging refrigerant in reservoir

Connect the cylinder with fresh R1234yf refrigerant to the service coupling on the high pressure side of the air conditioner service station ⇒ Operating instructions air conditioner service station .

- Perform a gas analysis on the refrigerant (from the cylinder supplied) with which the system is to be charged using the air conditioner service station  
⇒ **"2.3 Performing gas analysis of refrigerant", page 128** .
- The procedure described in the operating manual for your air conditioning service station is to be followed ⇒ Operating manual for air conditioner service station .



## CAUTION

Risk of explosion from overfilling refrigerant reservoirs.

Refrigerant can expand and cause reservoirs to burst if they are overfilled.

- Use a refrigerant tank with safety valve.
- Never exceed the permissible fill level of the refrigerant tank.



## Note

*Depending on the version of air conditioner service station and the measures to be performed, there is a minimum volume of refrigerant, refrigerant oil and UV leak detection additive that must be in the respective supply tank of the air conditioner service station ⇒ Operating instructions air conditioner service station*

## 2.10 Emptying air conditioner service station



## Note

- ◆ If it is necessary to discharge the air conditioner service station (e.g. because contaminated refrigerant was extracted), all filters and dryers must be renewed (do not remove filter and dryer from the air-tight transport package until immediately before installation to keep absorption of moisture as low as possible).
- ◆ If it is necessary to empty the air conditioner service station (e.g. because certain measures have to be performed on the air conditioner service station and the refrigerant that has been or is to be extracted from the air conditioner service station complies with the specifications (is not contaminated), it can be filled into a recycling cylinder, if necessary, and then reused ⇒ Operating instructions air conditioner service station .
- ◆ Refrigerant cylinders that have been charged with contaminated or used refrigerant are referred to as "recycling cylinders" or "R cylinders".
- ◆ Always evacuate recycling cylinders before the first filling (refrigerant cylinders containing air must not be filled with refrigerant).
- ◆ Different types of refrigerant must not be mixed together (mixtures of refrigerant cannot be recycled, but must be disposed of instead). If the composition of the contents in the cylinder is not clear, the gas processing / gas disposal company must be informed of this  
⇒ "2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal", page 155 and  
⇒ "6.2.17 Returning contaminated R1234yf refrigerant for analysis, processing or disposal", page 25 .

## CAUTION

Risk of explosion from overfilling refrigerant reservoirs.

Refrigerant can expand and cause reservoirs to burst if they are overfilled.

- Use a refrigerant tank with safety valve.
- Never exceed the permissible fill level of the refrigerant tank.

There are various ways to empty an air conditioner service station , observe the operating instructions of the air conditioner





service station ⇒ Operating instructions air conditioner service station .

- Drain the refrigerant from the air conditioner service station to be emptied into a different air conditioner service station , observing the operating instructions of the air conditioner service station to do so ⇒ Operating instructions air conditioner service station and  
⇒ ["2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal", page 155](#) .

## 2.11 Cleaning electrical air conditioning compressor

### Vehicles with high-voltage system

Observe the additional warning instructions for working on vehicles with high-voltage system ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .

If repair work in the vicinity of high-voltage components and cables is necessary, carry out a visual check for damage on high-voltage components and cables, and observe the warnings ⇒ Electrical system; Rep. gr. 93 ; General warnings for work on the high-voltage system .

If repair work on high-voltage components is necessary, de-energise the high-voltage system ⇒ Electrical system; Rep. gr. 93 ; De-energising high-voltage system "and "observe the general warning instructions for work on the high-voltage system" ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system.

### Flushing air conditioner compressor



#### Note

- ◆ *On an electrical air conditioning compressor, the refrigerant oil cannot be poured out (as there is no oil drain plug), i.e. the design makes no allowance for the drainage of oil*
- ◆ *With an electrical air conditioning compressor, the refrigerant oil is to be removed in the direction of flow by flushing (flushing in the opposite direction of flow is not possible due to the integrated valves).*
- ◆ *The air conditioner compressor must be positioned for flushing so that the connection for the refrigerant line on the high pressure side is at the lowest point possible.*





## 1 - Air conditioner service station

- ❑ With electronics and flushing program, air conditioner service station with flushing device ➔ Electronic parts catalogue .
- ❑ If an air conditioner service station without flushing program is used, the sequence has to be carried out manually (evacuate, flush 4 times with at least 2 kg of refrigerant each time and extract refrigerant again, evacuate).

## 2 - Refrigerant hose of air conditioner service station

- ❑ From high pressure side of air conditioner service station (normally coloured red) for connecting low pressure side of air conditioner compressor to refrigerant circuit (larger diameter)

## 3 - Adapter to connection for low pressure side on air conditioner compressor

- ❑ Different versions depending on vehicle  
➔ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ❑ The item to be used between the refrigerant hose -2- and adapter -3- is adapter - VAS 6338/48- .
- ❑ From adapter case VW/Audi passenger vehicle set

## 4 - Refrigerant line

- ❑ For connection of air conditioner compressor to adapter ➔ [Item 3 \(page 150\)](#)

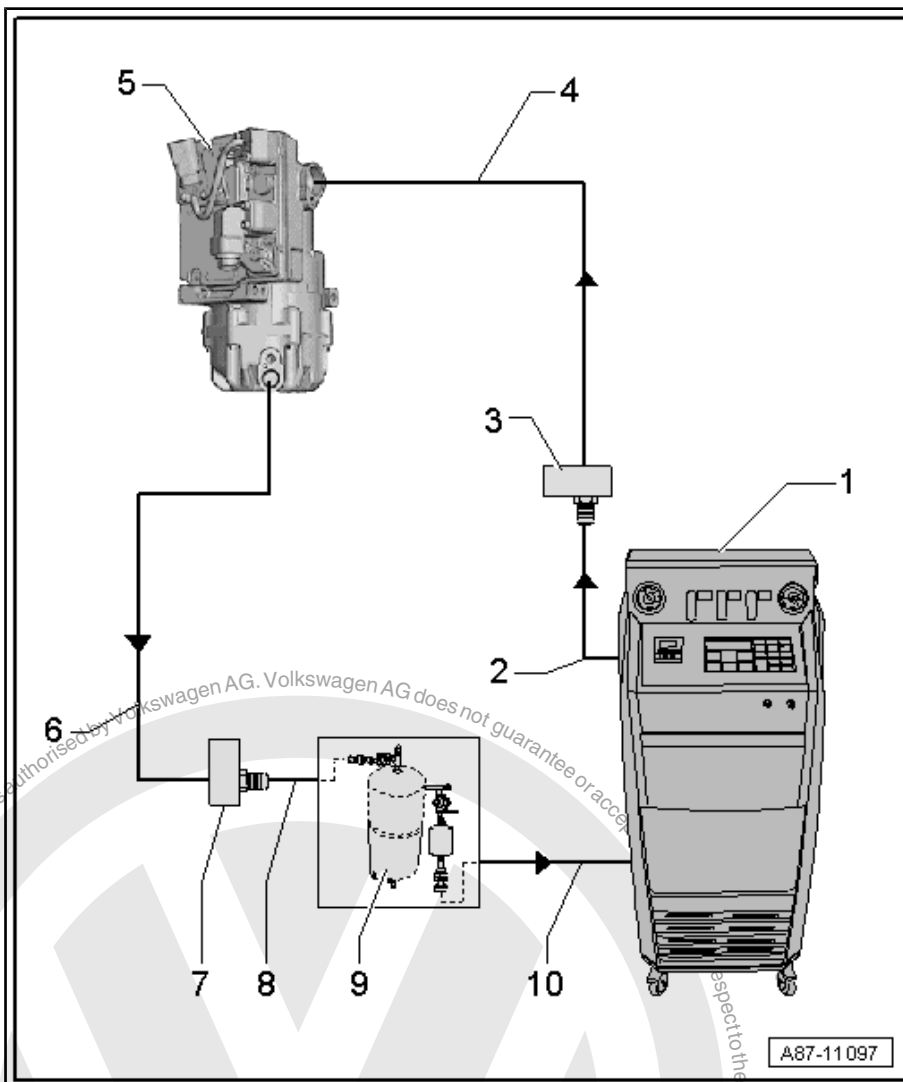
## 5 - Electrical air conditioner compressor

- ❑ Flush the air conditioner compressor in normal direction of flow (from low pressure inlet to high pressure outlet)
- ❑ In order to flush as much refrigerant oil out of the air conditioner compressor as possible, make sure that the high pressure outlet of the air conditioner compressor is in the lowest position possible



### Note

- ◆ Depending on the air conditioner compressor, a new air conditioner compressor might be filled with quite a large amount of refrigerant oil (see manufacturer plate on air conditioner compressor and ➔ ["5.2 Refrigerant oil capacities", page 15](#) ).





- ◆ *On a new air conditioner compressor filled with more than 150 cm<sup>3</sup>, pour out as much refrigerant oil as possible before flushing.*
- ◆ *Reason: The oil volume to be displaced in one work step may be restricted depending on the version of air conditioner service station .*



#### Note

*If the clean refrigerant oil is poured out of a new air conditioner compressor into a clean container and this is subsequently sealed air-tight, the refrigerant oil can be re-used to top-up the refrigerant oil volume in the circuit.*

### 6 - Refrigerant line

- ☐ For connection of air conditioner compressor to adapter ⇒ [Item 7 \(page 151\)](#)
- ☐ Use a refrigerant line e.g. with part number 7L6 820 721 BF to set-up the flushing circuit ⇒ Electronic parts catalogue

### 7 - Adapter for connection on high pressure side of air conditioner compressor

- ☐ Different versions depending on vehicle ⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)
- ☐ From adapter case VW/Audi passenger vehicle set

### 8 - Charging hose of flushing device for refrigerant circuits

- ☐ From connection to high pressure side of air conditioner compressor on refrigerant circuit (smaller diameter) to inlet of flushing device for refrigerant circuits.

### 9 - Flushing device for refrigerant circuits

- ☐ Different versions and different design of flushing devices for refrigerant circuits ⇒ Electronic parts catalogue (Tools; Workshop equipment/tools; Air conditioning/heating)
- ☐ With filter, sight glass, safety valve, heating, refrigerant tank, etc. (depending on version).
- ☐ Depending on the layout of the air conditioner service station and the flushing device for refrigerant circuits, there may be a service coupling for refrigerant circuits fitted at the outlet and in some cases at the inlet of the flushing device. If a service connection with a valve is installed to the outlet of the flushing device, this valve must be opened completely when the service coupling is connected. If the valve is not opened completely, it restricts the refrigerant flow.
- ☐ If there is a connection for a service coupling fitted at the inlet of the flushing device, the inlet must be adapted to allow for the refrigerant hose coming from the vehicle to be connected directly.



#### Note

*A service coupling and a valve in the inlet of the flushing device restrict the refrigerant flow from the vehicle into the flushing device.*

### 10 - Refrigerant hose of air conditioner service station

- ☐ From the low pressure side of the air conditioner service station (normally coloured blue) to the outlet of the flushing device for refrigerant circuits.

## 2.12 Cleaning refrigerant circuit

- Perform preparatory measures for cleaning (flushing with R1234yf refrigerant)



⇒ ["1.6.2 Preparations for cleaning refrigerant circuit \(flushing with R1234yf refrigerant\)", page 93](#)

- Check the refrigerant volume in the air conditioner service station . There must be at least 6 kg of R1234yf refrigerant ⇒ Operating instructions of air conditioner service station .
- Empty container for used oil of air conditioner service station ⇒ Operating instructions of air conditioner service station .
- Connect the supply hose (high pressure side) of the air conditioner service station with an adapter to the low pressure line leading to the air conditioner compressor (line with larger diameter)  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#) .
- Connect the return hose (low pressure or suction side) of the air conditioner service station to the outlet of the flushing device for refrigerant circuits.
- Connect the inlet of the flushing device for refrigerant circuits with an adapter to the high pressure line leading to the air conditioner compressor (line with smaller diameter)  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#) .
- ◆ Principle circuit diagrams for various flushing circuits  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#)
- ◆ Adapters for setting up flushing circuits  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#)





## Note

- ◆ *The components are almost always flushed against the direction of refrigerant flow when the air conditioning system is in operation. (Exception: electrically-actuated air conditioner compressor) ⇒ [page 91](#)*
- ◆ *When flushing, contaminants from the refrigerant circuit enter the flushing device for refrigerant circuits and the air conditioner service station and are retained in the filters and dryers installed within. Depending on the contamination, these components must be renewed at shorter intervals than prescribed as per the operating instructions of the air conditioner service station or flushing device for refrigerant circuits ⇒ Operating instructions of air conditioner service station .*
- ◆ *The filter in the flushing device for refrigerant circuits should be changed (depending on the type and severity of contamination in the flushed refrigerant circuits) after about 5 to 10 flushing cycles (flushed vehicles). If a heavily contaminated refrigerant circuit is flushed (the refrigerant oil from the refrigerant circuit is black and viscous or there are large amounts of swarf in the refrigerant circuit), renew the filter after flushing this refrigerant circuit. After such heavy contamination of the refrigerant circuit, it is a good idea to flush the system again after replacing the filter.*
- ◆ *Depending on the type of contamination, deposits (old refrigerant oil and friction dust from the air conditioner compressor) will gather in the sight glass of the rinsing device for refrigerant circuits. If necessary, clean this sight glass after flushing and flush the refrigerant circuit through again to make sure it is clean (one pass is sufficient in this instance).*
- ◆ *Liquid refrigerant cannot be routed through the expansion valve, restrictor and desiccant bag of certain receivers at the necessary rate. Therefore remove these components and replace them with adapters if applicable ⇒ [page 91](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *Adapters to connect air conditioner service station and to bridge certain components of the refrigerant circuit  
⇒ ["1.6.7 Adapters for setting up flushing circuits", page 105](#) .*

**Perform flushing (the procedure runs automatically as per the program in the air conditioner service station ⇒ Operating instructions of air conditioner service station )**

- Switch on the air conditioner service station ⇒ Operating instructions of air conditioner service station .
- Select the flushing program on the air conditioner service station ⇒ Operating instructions of air conditioner service station .
- Flush the refrigerant circuit (duration approx. 1 to 1.5 hours for one flushing cycle with 4 cycles) ⇒ Operating instructions of air conditioner service station .



## Note

- ◆ *Flushing procedure*  
⇒ ["1.6.3 Refrigerant circuit cleaning procedure", page 96](#) .
- ◆ *Perform flushing as instructed in the operating manual of the air conditioning service station ⇒ Operating instructions of air conditioner service station .*
- ◆ *Depending on the type of air conditioning service station , the used oil tank has a capacity of about 125 cm<sup>3</sup> of refrigerant oil. If a system with a greater amount of refrigerant oil has to be flushed, it may be necessary to empty the used oil tank after the first flushing process of a flushing cycle.*
- ◆ *Observe the refrigerant flowing back into the air conditioning service station from the refrigerant circuit. Once the refrigerant flows clear and completely colourless through the inspection window of the flushing device for refrigerant circuits in the air conditioning service station , the refrigerant circuit is cleaned.*
- ◆ *When flushing, the whole amount of refrigerant oil from the refrigerant circuit is washed out (except for a very small amount, e.g. in the evaporator, but this is negligible).*
- ◆ *Where contamination is particularly high, it may be necessary to carry out the flushing process twice (two flushing cycles with 4 flushing processes each).*
- At the end of the flushing process, check the inspection window or windows of the flushing device for refrigerant circuits. If dirty, clean as per the instructions of the flushing device for refrigerant circuits or air conditioner service station and perform the flushing process again to be safe (running through once over a period of approx. 30 min. is sufficient) ⇒ Operating instructions air conditioner service station .
- Check the pressure in the refrigerant circuit. There must be no overpressure in the refrigerant circuit (evacuate twice briefly if necessary).
- Remove the connections to the air conditioning service station from the refrigerant circuit of the vehicle (there should be no overpressure in the refrigerant circuit)
- Renew these vehicle-specific components (restrictor and reservoir, expansion valve and receiver / dryer cartridge in the reservoir) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .
- Depending on the complaint, renew the air conditioner compressor ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue or drain the remaining refrigerant oil from the removed air conditioner compressor ⇒ ["1.5 Renewing components", page 78](#) and fill with the requisite amount of fresh refrigerant oil again ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; Refrigerant oil .





#### Note

- ◆ *Replacement compressors contain a certain specified quantity of refrigerant oil. On vehicles with two evaporators, a certain amount of refrigerant oil may also have to be filled in the circuit if necessary ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; Refrigerant oil .*
- ◆ *If the air conditioner compressor does not need to be renewed, replenish the refrigerant oil accordingly up to the prescribed fill level (empty or flush refrigerant oil and pour the prescribed volume back into the air conditioner compressor or refrigerant circuit) ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; refrigerant oil .*
- Completely reassemble the refrigerant circuit again ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- Evacuate and charge the refrigerant circuit in accordance with the specifications  
⇒ ["2.5 Evacuating refrigerant circuit", page 134](#) ,  
⇒ ["2.6 Charging refrigerant circuit", page 140](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data .
- Bring the air conditioning system into operation in the prescribed manner ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; Bringing air conditioning system into operation after charging refrigerant circuit (vehicle-specific workshop manual) and  
⇒ ["2.7 Bringing air conditioning system into service after charging", page 143](#)

## 2.13 Filling contaminated refrigerant in a recycling cylinder for analysis, processing or disposal

⇒ ["2.13.1 Filling contaminated refrigerant in a recycling cylinder using technical equipment", page 155](#)

⇒ ["2.13.2 Filling undercooled contaminated refrigerant in a recycling cylinder", page 158](#)

### 2.13.1 Filling contaminated refrigerant in a recycling cylinder using technical equipment



#### Note

- ◆ *Some manufacturers may provide accessory devices (extracting or disposal units) that they claim to be approved for the extraction of gases of unknown composition. These devices, however, have not been tested or approved by Volkswagen so that we cannot draw any conclusions about their operation or suitability.*
- ◆ *In order to be filled into an evacuated recycling cylinder without any auxiliary equipment, the contaminated refrigerant must be supercooled. The corresponding procedure has been approved by Volkswagen and described accordingly  
⇒ [page 158](#) .*





### CAUTION

**Risk of explosion if non-approved equipment is used**

Refrigerant of unknown composition may expand due to a chemical reaction or overheating causing the used device to burst.

- Make sure to use only devices and accessories that have been authorised and approved by the manufacturer for being suitable for operation with gases of unknown composition in accordance with the relevant rules and regulations.
- Always read the owner's manual of these devices before using them.
- Make sure to comply with all instructions given in the respective owner's manual when using the devices.

### CAUTION

**Risk of explosion from overfilling refrigerant reservoirs.**

Refrigerant can expand and cause reservoirs to burst if they are overfilled.

- Use a refrigerant tank with safety valve.
- Never exceed the permissible fill level of the refrigerant tank.

### CAUTION

**Chemical reactions from contaminated refrigerant. Mixing gases of unknown composition can cause different chemical reactions.**

**Risk of injuries.**

- Never mix together refrigerants of different origins.

Extract refrigerant of unknown composition from refrigerant circuit and collect it in a recycling cylinder.

- Connect the extracting and charging unit to the refrigerant circuit of the vehicle and to a recycling cylinder observing the corresponding owner's manual.
- Operate the extracting and charging unit according the instructions in the corresponding owner's manual.
- Monitor the extraction process using a suitable pressure gauge.



### Note

- ◆ *You can use your own pressure gauge or the pressure gauge of the air conditioner service station to monitor the extraction process.*
- ◆ *As it will take some time until the entire contaminated refrigerant has been extracted from the refrigerant circuit, make sure that you do not switch off the extracting and charging unit until the refrigerant circuit has been drained completely. To be absolutely sure about this, watch the display of the connected pressure gauge.*

After the entire contaminated refrigerant has been extracted from the circuit:

- Switch off unit.
- Close the manual shut-off valve of the recycling cylinder.



- Wait a certain amount of time (e.g. 20 minutes), then check if pressure started building up again in the vehicle's refrigerant circuit.



#### Note

*If pressure builds up in the refrigerant circuit due to evaporation of the refrigerant, fill the refrigerant into the recycling cylinder.*

- Remove the charge hose and adapter from the recycling cylinder, and seal the connection of the recycling cylinder with the sealing cap.
- The paperwork required for analysis, processing (or disposal) of contaminated refrigerant must be filled in completely (disposal record, acceptance certificate etc.).



#### Note

- ◆ *All of the information and documents for analysis, processing (or disposal) can be obtained from your gas processing / gas disposal company.*
- ◆ *Included with the recycling cylinder is a form. Kindly fill this in accordingly and attach it to the recycling cylinder.*
- ◆ *If it is not possible to weigh the recycling cylinder before and after filling with contaminated refrigerant, the fill volume specified for the vehicle in question can be quoted as the amount of refrigerant that was filled in the recycling cylinder. This is permissible as only the amount of refrigerant from a vehicle is filled in a recycling cylinder.*
- Take the recycling cylinder to a suitable location for storage until it is ready to be collected by the gas processing / gas disposal company.
- Fill out the data sheet for the recycling cylinder (R-cylinder) if the refrigerant is contaminated, and firmly attach it to the recycling cylinder.



#### Note

- ◆ *In the "Other comments" section, details can be provided regarding e.g. who is to receive the analysis results and in which way.*
- ◆ *Example for recycling cylinder (R-cylinder) data sheet*  
*⇒ [page 163](#).*
- Evacuate the refrigerant circuit with the air conditioner service station for at least 1 hour  
*⇒ ["2.5 Evacuating refrigerant circuit", page 134](#).*



#### Note

- ◆ *Subsequent evacuation results in the last remnants of contaminated refrigerant, which could still be in the refrigerant oil, being removed at an absolute pressure of less than 10 mbar.*
- ◆ *If, after the unit has been switched off, a pressure that is higher than the maximum permissible pressure for the function "Evacuate" to be started on the air conditioner service station builds up in the refrigerant circuit, release this pressure (drain refrigerant) into the workshop extraction unit.*
- ◆ *The next steps depend on the complaint with the refrigerant circuit  
⇒ ["2.3 Performing gas analysis of refrigerant", page 128](#).*

### 2.13.2 Filling undercooled contaminated refrigerant in a recycling cylinder



#### Note

- ◆ *To ensure that the contaminated refrigerant is filled automatically without supporting equipment into an evacuated recycling cylinder, the cylinder must be supercooled.*
- ◆ *To cool down the evacuated recycling bottle, use an insulated container and dry ice.*
- ◆ *Dry ice is solid carbon dioxide (CO<sub>2</sub>) that changes from a solid directly to a gaseous state at -78°C.*
- ◆ *Most of the gases used as refrigerant have only a low vapour pressure at very low temperatures (less than 0.6 bar absolute pressure at -50°C). When an extremely cooled recycling cylinder is connected to a refrigerant circuit, the refrigerant liquefies in the cold recycling cylinder and the pressure in the refrigerant circuit drops below ambient pressure  
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 17](#).*
- ◆ *Commercially available recycling cylinders are usually made of common mild steel. These are not always suitable for low temperatures (down to -78°C in this case), which is why only recycling cylinders suitable for this application should be used and why the cylinder should be allowed to reach ambient temperature slowly (e.g. by placing the insulated container with recycling cylinder in a secure, well-ventilated location where the dry ice can evaporate safely).*

#### Special tools and workshop equipment required

- ◆ Extraction unit - VAS 581 007- ⇒ Electronic parts catalogue (ETKA)
- ◆ At least 10 kg of commercially available dry ice (pellets or granules)
- ◆ Evacuated recycling cylinder from gas supplier for contaminated R1234yf refrigerant, which is suitable for very low temperatures (e.g. with a permissible fill capacity greater than 3.0 kg).
- ◆ Commercially available bottle adapter with seal (for connecting charge hose to recycling bottle, internal W 21.8 x 1/14 LH left-hand thread and M 12 x 1.5-6G in accordance with SAE J639)



- ◆ Commercially available charge hose for R1234yf refrigerant with seals (2m charge hose with external M12 x 1.5-6G thread in accordance with SAE J639)
- ◆ Commercially available low-pressure service coupling in accordance with SAE J639



#### Note

*Dry ice evaporates at ambient temperature even from the insulated container (about 20 to 30% per day depending on the ambient conditions). Therefore, only order the dry ice once all of the necessary tools are ready and the measures can be performed immediately after receipt of the dry ice (e.g. do not order the dry ice on a Friday if work is not going to be carried out at the weekend).*



#### CAUTION

**Risk of frost-bite and suffocation from dry ice.**

**Frost-bite on the skin and other body parts possible and risk of suffocation in gaseous state.**

- Wear protective gloves.
- Wear protective goggles.
- Only work with dry ice in well ventilated areas.
- Never work in or near cellars or other low lying areas.



#### CAUTION

**Risk of explosion from incorrectly stored dry ice.**

**As dry ice evaporates, pressure builds up in the container. Unsuitable containers could burst.**

- Only transport and store dry ice in dedicated containers.

#### Refilling refrigerant using a supercooled recycling cylinder

- All requisite tools, equipment and a sufficient quantity of dry ice ready
- Remove seal on recycling cylinder and unscrew sealing cap from connection.



## Note

- ◆ *Sealed recycling cylinders from your gas supplier usually come pre-evacuated.*
- ◆ *Should the recycling cylinder not be evacuated, evacuate it as necessary using a vacuum pump or an air conditioner service station .*
- ◆ *Recycling cylinders are clearly marked as such and, unlike refrigerant cylinders, do not have a non-return valve thereby making them suitable for filling.*
- ◆ *Recycling cylinders are designed for international use, which is why the "O" on the handwheel means "Open" (cylinder valve = open) and not "0" (zero = closed).*
- ◆ *If an absolute pressure greater than 100 mbar but less than 900 mbar is measured in the recycling cylinder, evacuate the recycling cylinder using a vacuum pump (or an air conditioner service station ) (residual pressure less than 50 mbar)  
⇒ ["2.5 Evacuating refrigerant circuit", page 134](#) .*
- ◆ *If an absolute pressure greater than 900 mbar is measured in the recycling cylinder, this could be due to a number of reasons. The manual shut-off valve was opened and not closed properly or the recycling cylinder had previously been used to store refrigerant and then was not evacuated properly  
⇒ ["2.10 Emptying air conditioner service station", page 148](#) (evacuate recycling cylinder). The recycling cylinder is leaking (return the recycling cylinder to the supplier).*
- Connect a vacuum metre (or air conditioner service station ) to the recycling cylinder.
- Carefully open the manual shut-off valve of the recycling cylinder to check the vacuum and then check the vacuum in the cylinder.
- If necessary, evacuate the recycling cylinder with the air conditioner service station .



## Note

- ◆ *Should there be any air trapped in the recycling cylinder, it can be evacuated using an air conditioner service station for R1234yf. To do this, unscrew the low pressure service coupling from the charge hose of the air conditioner service station and connect the charge hose directly to the recycling cylinder adapter for the extraction device (for R1234yf refrigerant) - dry ice box .*
- ◆ *If air is trapped in the recycling cylinder and there is no air conditioner service station for R1234yf available, the recycling cylinder can also be evacuated with an air conditioner service station for R134a using a relevant flushing container and adapter -VAS 6338/38- along with the charge hose from extraction device (for R1234yf refrigerant) - dry ice box .*
- Residual pressure in the recycling cylinder less than 10 mbar absolute pressure.



#### Note

- ◆ *Recycling cylinders are pre-evacuated by the supplier, though it is not always possible to ensure that the vacuum will remain intact in storage.*
- ◆ *To reliably determine the type and scope of the contamination of the refilled refrigerant during analysis of the contaminated refrigerant, the recycling cylinder must be evacuated before refilling to a residual pressure less than 50 mbar.*
- Switch off ignition.
- Ensure that the workplace is well ventilated. Switch on additional workshop extraction systems if fitted.
- Connect the charge hose with a suitable adapter to the evacuated recycling cylinder.



#### CAUTION

**Risk of explosion from overfilling refrigerant reservoirs.**

**Refrigerant can expand and cause reservoirs to burst if they are overfilled.**

- Use a refrigerant tank with safety valve.
- Never exceed the permissible fill level of the refrigerant tank.



#### Note

- ◆ *Since contaminated refrigerant is only filled into a recycling cylinder from a vehicle in the following work routine, there is no danger of a recycling cylinder being overfilled with a fill volume exceeding 3.0 kg.*
- ◆ *If contaminated refrigerant is filled into a recycling cylinder e.g. from an air conditioner service station, measures must be taken to ensure that the recycling cylinder is not overfilled due to the larger volume. Use a recycling cylinder with an appropriate permissible fill capacity and when refilling ensure by means of weighing that the maximum permissible fill volume is not exceeded.*



#### CAUTION

**Chemical reactions from contaminated refrigerant. Mixing gases of unknown composition can cause different chemical reactions.**

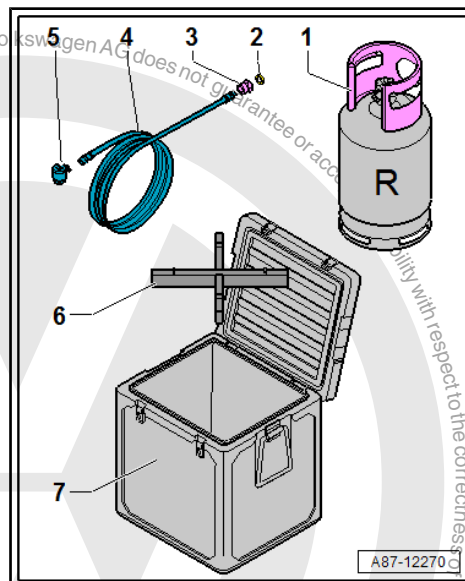
**Risk of injuries.**

- Never mix together refrigerants of different origins.





- Connect the service coupling for R1234yf refrigerant -5- to the charge hose -4-.
- Connect the charge hose -4- with cylinder adapter -3- (and seal -2-) to the recycling cylinder -1-.
- Place the spacer -6- in the insulated container -7-.
- Cover the base of the insulated container -7- with dry ice.
- Place the recycling cylinder -1- in the insulated container -7- extraction device (for R1234yf refrigerant) - dry ice box .
- Pour the remainder of the dry ice in the insulated container -7-.
- Cool down the recycling container -1- with dry ice (for approx. 15 minutes).
- Connect the recycling cylinder -1- via the service coupling -5- to the connection of the air conditioner service station (or the vehicle's refrigerant circuit).
- Open the manual shut-off valve of the recycling cylinder -1-.



#### Note

*Recycling cylinders are designed for international use, which is why the "O" on the handwheel means "Open" (cylinder valve = open) and not "0" (zero = closed).*

- Connect a pressure gauge to the refrigerant circuit (or use the pressure gauge of the air conditioner service station ) and check the pressure in the refrigerant circuit.
- Carefully open the service coupling -5- on the charge hose for the recycling cylinder and allow the refrigerant to flow out slowly into the recycling cylinder -1-.
- Wait until the refrigerant in the recycling cylinder -1- has liquefied (watch the display on the connected pressure gauge).



#### Note

- ◆ *You can use your own pressure gauge or the pressure gauge of the air conditioner service station to monitor the extraction process.*
- ◆ *As soon as the displayed pressure is less than 0.3 bar after approx. 60 minutes, it is safe to assume that the whole refrigerant in the recycling cylinder is liquefied.*
- ◆ *Complete evaporation of the contaminated refrigerant from the refrigerant circuit takes some time. After 60 minutes, it is safe to assume that the whole refrigerant has evaporated.*
- Close the service coupling -5- and manual shut-off valve of the recycling cylinder -1-.
- Detach charge hose -4- and adapter -3- from recycling cylinder -1-, and seal connection of recycling cylinder with sealing cap.
- The paperwork required for analysis, processing (or disposal) of contaminated refrigerant must be filled in completely (disposal record, acceptance certificate etc.).



#### Note

- ◆ *All of the information and documents for analysis, processing (or disposal) can be obtained from your gas processing / gas disposal company.*
- ◆ *Included with the recycling cylinder is a form. Kindly fill this in accordingly and attach it to the recycling cylinder.*
- ◆ *If it is not possible to weigh the recycling cylinder before and after filling with contaminated refrigerant, the fill volume specified for the vehicle in question can be quoted as the amount of refrigerant that was filled in the recycling cylinder. This is permissible as only the amount of refrigerant from a vehicle is filled in a recycling cylinder.*
- Move the insulated box -7- with recycling cylinder -1- and dry ice to a secure, well ventilated area outside the building.
- Open the lid of the insulated box -7- or remove and allow the dry ice to evaporate.



#### Note

*Do not take the recycling cylinder -1- out of the insulated container -7- until the dry ice has evaporated and the recycling cylinder has adjusted to ambient temperature.*

- Remove the recycling cylinder -1- from the insulated container -7-.
- Take the recycling cylinder -1- to a suitable location for storage until it is ready to be collected by the gas processing / gas disposal company.
- Evacuate the refrigerant circuit with the air conditioner service station for at least 1 hour  
⇒ ["2.5 Evacuating refrigerant circuit", page 134](#) .



#### Note

- ◆ *Subsequent evacuation results in the last remnants of contaminated refrigerant, which could still be in the refrigerant oil, being removed at an absolute pressure of less than 10 mbar.*
- ◆ *The next steps depend on the complaint with the refrigerant circuit*  
⇒ ["2.3 Performing gas analysis of refrigerant", page 128](#) .
- Fill out the data sheet for the recycling cylinder (R-cylinder) if the refrigerant is contaminated and firmly attach it to the recycling cylinder -1-.



#### Note

*In the "Other comments" section, details can be provided regarding e.g. who is to receive the analysis results and in which way.*

Example for recycling cylinder (R-cylinder) data sheet



Data sheet for R-cylinder if refrigerant is contaminated	
<b>Service contact</b>	
Dealership contact:	
Email address:	
<b>Customer information:</b>	
Surname, first name:	
Street:	
Town/city:	
Vehicle model	
Identification	
Vehicle identification number:	
Mileage:	
Gas analysis performed on:	
<b>Information about R-cylinder</b>	
Cylinder number:	
Cylinder weight with contents: (gross weight)	
Fill volume (net weight)	
Other comments	

## 2.14 Checking pressures

⇒ [“2.14.1 General information on checking pressures in the refrigerant circuit”, page 164](#)

⇒ [“2.14.2 Pressures and temperatures in refrigerant circuit”, page 167](#)

⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 170](#)

⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#) .

⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)

### 2.14.1 General information on checking pressures in the refrigerant circuit



#### Note

*Work on the refrigerant circuit that involves the air conditioner service station can usually be carried out without the need to de-energise the high-voltage system.*



**Vehicles with electrically-actuated valves in the refrigerant circuit that are not open when unenergised:**



**Note**

*On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. To check the pressures in the refrigerant circuit with the air conditioning system switched off, however, no areas may be isolated, which is why these valves must be opened before work is carried out ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*

- Use the vehicle diagnostic tester to open the electrically-actuated valves that are not open when unenergised ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.

**All vehicles**



**NOTICE**

**Risk of damage to the air conditioner compressor or air conditioner service station.**

**Opening the valves with the air conditioning system switched on can cause a short circuit between the high pressure and low pressure side.**

- **Never open valves on the high pressure or low pressure side with the air conditioning system switched on.**



**Note**

- ◆ *Certain conditions for testing are pertinent to a certain vehicle and are described in the vehicle-specific workshop manual ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output.*
- ◆ *Check the cooling output ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *Connections with valve and service connections for measuring and testing ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual)*
- ◆ *Depending on the version of air conditioner compressor, a valve may be installed on the high-pressure side that prevents liquefied refrigerant flowing back into the air conditioner compressor after the air conditioning system is switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit with expansion valve, it could take some time before the pressure on the high-pressure side drops (the expansion valve is cold and the pressure on the low-pressure side rises quickly after switching off, the expansion valve closes and refrigerant only flows slowly on the low-pressure side). If the air conditioner compressor is switched on, the pressure on the low-pressure side drops, the expansion valve opens and refrigerant can flow on the low-pressure side.*



Under certain operating conditions, residual moisture in the refrigerant circuit may lead to the formation of ice at the air conditioner compressor regulating valve. The ice impairs the air conditioner compressor control and causes the evaporator to be cooled excessively and to ice up. Icing-up of the evaporator may give rise to the following problems:

- ◆ Repeated or sporadic failure of the air conditioner (no cooling/heat output) after a lengthy journey. After switching off the engine and waiting for a short period, operation of air conditioner returns to normal.
- ◆ Misting up of the windows on the inside after a long journey; the windows are initially not cleared even by pressing the De-frost button; the air conditioner functions properly again after a short delay following engine shut-off (or after switching off the air conditioner).

#### Remedy:

- On vehicles with an air conditioner compressor with air conditioner compressor regulating valve - N280- , check the measured value of the evaporator output temperature sender - G263- (via the "Read measured values" function). If the measured value of the sender is too low under the operating conditions described by the customer (at an ambient temperature above 0°C, colder than 0°C for an extended period even though the -N280- is currently not actuated) or too high (higher than approx. 10°C, even though the air conditioning system is functioning properly): the evaporator may ice up due to the incorrect measured value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- On vehicles without evaporator output temperature sender - G263- , use e.g. the footwell vent temperature sender - G192- to check the outlet temperature with the temperature set to "low" or "cold" for the driver and front passenger side with the lowest setting (4 or 5 bars) for the fresh air blower speed, air outlet in the footwell and fresh air mode under the operating conditions described by the customer. If the measured value of the sender is too low (with an ambient temperature higher than 0°C, colder than 0°C for an extended period), the evaporator could ice up due to the wrong measured value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
- On vehicles with shut-off valves in the refrigerant circuit, check the function and actuation of these valves ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system, ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- Check the refrigerant line from the evaporator (or from the inner heat exchanger) and the air conditioner compressor (thick pipe, low pressure side) with the engine running. If this line is very icy when the complaint is encountered (a thin layer of ice is acceptable), this is also evidence that the temperature in the evaporator is too low ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual).
- Empty the refrigerant circuit, renew the receiver with dryer, renew the reservoir with dryer or desiccant cartridge, and then evacuate the refrigerant circuit for at least 3 hours ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit (vehicle-specific workshop manual) and ⇒ [page 123](#) .





- ◆ ⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 170](#)
- ◆ ⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#) .
- ◆ ⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)

## 2.14.2 Pressures and temperatures in refrigerant circuit

General information about pressures and temperatures in the refrigerant circuit ⇒ [page 167](#)

Pressures and temperatures in refrigerant circuit with expansion valve ⇒ [page 168](#)

General information about pressures and temperatures in the refrigerant circuit

- ◆ The pressures and temperatures in the refrigerant circuit depend on the current operating conditions (e.g. engine speed, radiator running at level 1, 2, or 3, engine temperature, air conditioner compressor actuation on or off) as well as environmental influences (e.g. ambient temperature, humidity, required cooling output).
- ◆ On vehicles with air conditioner compressor regulating valve - N280- , the pressure on the low pressure side is varied by means of -N280- actuation.
- ◆ For these reasons, the values given in the following table may only be considered guidelines. They occur at an engine speed of 1,500 to 2,000 rpm and an ambient temperature of 20°C after about 20 minutes.
- ◆ Refer to the vehicle-specific refrigerant circuit for the pressure gauge set measurement connections ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ At 20°C and with the engine stationary, the refrigerant circuit will adjust itself to a pressure of 4.7 bar overpressure ⇒ [“6.1.3 Vapour pressure table for refrigerant”, page 17](#) (vapour pressure table).



### Note

- ◆ *Pressure is indicated in various units: 1 MPa (Mega-Pascal) is equal to 10 bar or 145 psi; 1 bar absolute pressure is equal to 0 bar, which is about the same as ambient pressure (atmospheric pressure).*
- ◆ *The pressures and temperatures in refrigerant circuits with restrictor and reservoir are about the same as those in refrigerant circuits with expansion valve. Since Volkswagen/Audi currently only installs refrigerant circuits with expansion valve, just this refrigerant circuit is described here.*



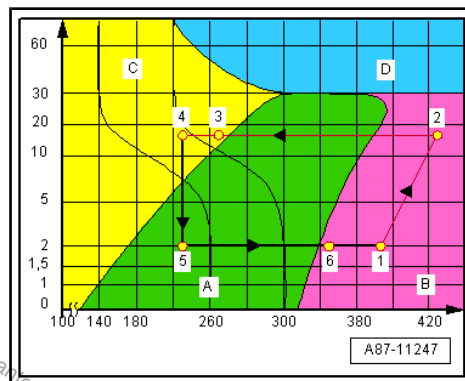


## Pressures and temperatures in refrigerant circuit with expansion valve



### Note

- ♦ The following log (p), h-diagram (logarithmic pressure, energy diagram) shows the processes that run during certain operating conditions in the refrigerant circuit. These values change depending on the environmental conditions (engine speed, ambient temperature, requisite cooling output, etc.).
- ♦ The log (p), h-diagram shows the pressure (0 to 60 in bar absolute pressure) and the energy content (100 to 420, specific enthalpy in kilojoules per kg of R1234yf refrigerant) in the refrigerant circuit cycle.
- ♦ The arrows indicate the direction of refrigerant flow in the refrigerant circuit.



A - Area with vaporous refrigerant

B - Area with gaseous refrigerant

C - Area with liquefied refrigerant

D - Supercritical pressure and temperature range, physical state of refrigerant undetermined (no longer a separation between liquefied and gaseous refrigerant)

- 1 - Low pressure side: output of inner heat exchanger, input of air conditioner compressor, refrigerant is completely evaporated and gaseous, temperature of refrigerant is approx. -4°C
- 2 - High pressure side: output of air conditioner compressor, input of condenser, refrigerant has been compressed and is gaseous, temperature of refrigerant is up to approx. 80°C
- 3 - High pressure side: output of condenser (receiver), input of inner heat exchanger, refrigerant has been cooled down and is liquefied, temperature of refrigerant is approx. 55°C
- 4 - High pressure side: output of inner heat exchanger, input of expansion valve, liquefied refrigerant has cooled down further, temperature of refrigerant is approx. 50°C
- 5 - Low pressure side: expansion valve on evaporator side, input of evaporator, liquefied refrigerant comes to rest and starts to evaporate, temperature of refrigerant approx. -7°C
- 6 - Low pressure side: output of evaporator, expansion valve, input of inner heat exchanger, refrigerant mainly evaporated, small percentage is still vaporous, temperature of refrigerant approx. -6°C



## Note

- ◆ *The temperatures given relate to the refrigerant in the refrigerant circuit. The temperatures deviate from this on the surface of components containing refrigerant owing to heat absorption and dissipation.*
- ◆ *The pressure and the temperature, too, are maintained at approx. 3 bar absolute pressure (equates to approx. 2 bar overpressure) in refrigerant circuits with regulated air conditioner compressor despite thermal changes and different engine speeds. This applies however only within the rated range of the air conditioner compressor; if the rated range of the air conditioner compressor is exceeded, the pressure will increase and so, too, will the temperature  
⇒ ["2.14 Checking pressures", page 164](#).*
- ◆ *On air conditioner compressors that do not regulate their performance themselves, the pressure on the low pressure side and thereby the evaporator temperature are regulated by the respective control via the air conditioner compressor regulating valve - N280-. Depending on the version and the setting, if an air temperature of less than approx. 2°C is measured after the evaporator, the performance of the air conditioner compressor is lowered. At below 0°C, -N280- actuation is switched off. This prevents the evaporator from cooling down too much and becoming icy.*
- ◆ *On vehicles with two evaporators and two expansion valves, the temperature and pressure in the refrigerant circuit are the same at the second evaporator as those in vehicles with only one evaporator and one expansion valve (parallel circuit).*
- ◆ *Depending on the version of refrigerant circuit, a component with inner heat exchanger may be installed. In the internal heat exchanger, the hot liquid refrigerant flowing on the high pressure side supplies energy to the cold gaseous or vaporous refrigerant flowing on the low pressure side, thus enhancing the efficiency of the air conditioner  
⇒ ["1.2.13 Refrigerant line with internal heat exchanger", page 50](#).*
- ◆ *Depending on the version of control unit (e.g. operating and display unit for front air conditioning system - E87- or Climatronic control unit - J255- ), the measured ambient conditions (exterior temperature, moisture in the passenger compartment etc.) and the control unit setting (passenger compartment temperature, operating mode etc.), the pressure and thereby also the temperature at the output of the evaporator can also be regulated at a higher temperature ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*



## 2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off

Test prerequisites ⇒ [page 170](#)

Checking pressures with the ignition switched off ⇒ [page 173](#)

Conditions for testing



### Note

- ◆ *Work on the refrigerant circuit that involves the air conditioner service station (checking the pressures in this case) can usually be carried out without the need to de-energise the high-voltage system.*
- ◆ *Only de-energise the high-voltage system if work on the high-voltage system is necessary ⇒ [page 3](#)*

All vehicles



### Note

- ◆ *Certain conditions for testing are pertinent to a certain vehicle and are described in the vehicle-specific workshop manual ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *Depending on the version of air conditioner compressor, a valve may be installed on the high-pressure side that prevents liquefied refrigerant flowing back into the air conditioner compressor after the air conditioning system is switched off. If an air conditioner compressor with this valve is installed in a vehicle with a refrigerant circuit with expansion valve, it could take some time before the pressure on the high-pressure side drops (the expansion valve is cold and the pressure on the low-pressure side rises quickly after switching off, the expansion valve closes and refrigerant only flows slowly on the low-pressure side). If the air conditioner compressor is switched on, the pressure on the low-pressure side drops, the expansion valve opens and refrigerant can flow on the low-pressure side.*
- ◆ Check the cooling output ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- ◆ Connections with valve and service connections for measuring and testing ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Connect the air conditioner service station  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#).

Under certain operating conditions, residual moisture in the refrigerant circuit may lead to the formation of ice at the air conditioner compressor regulating valve. The ice impairs the air conditioner compressor control and causes the evaporator to be cooled excessively and to ice up. Icing-up of the evaporator may give rise to the following problems:

- ◆ Repeated or sporadic failure of the air conditioner (no cooling/heat output) after a lengthy journey. After switching off the engine and waiting for a short period, operation of air conditioner returns to normal.



- ◆ Misting up of the windows on the inside after a long journey; the windows are initially not cleared even by pressing the De-frost button; the air conditioner functions properly again after a short delay following engine shut-off (or after switching off the air conditioner).

#### Remedy:

- On vehicles with an air conditioner compressor with air conditioner compressor regulating valve - N280- , check the measured value of the evaporator output temperature sender - G263- (via the "Read measured values" function). If the measured value of the sender is too low under the operating conditions described by the customer (at an ambient temperature above 0°C, colder than 0°C for an extended period even though the -N280- is currently not actuated) or too high (higher than approx. 10°C, even though the air conditioning system is functioning properly): the evaporator may ice up due to incorrect actuation of -N280- or the incorrect measured value of -G263- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- On vehicles without evaporator output temperature sender - G263- , use e.g. the footwell vent temperature sender - G192- to check the outlet temperature with the temperature set to "low" or "cold" for the driver and front passenger side with the lowest setting (4 or 5 bars) for the fresh air blower speed, air outlet in the footwell and fresh air mode under the operating conditions described by the customer. If the measured value of the sender is too low (with an ambient temperature higher than 0°C, colder than 0°C for an extended period), the evaporator could ice up due to the wrong measured value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
- On vehicles with shut-off valves in the refrigerant circuit, check the function and actuation of these valves ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- Check the refrigerant line from the evaporator (or from the inner heat exchanger) and the air conditioner compressor (thick pipe, low pressure side) with the engine running. If this line is very icy when the complaint is encountered (a thin layer of ice is acceptable), this is also evidence that the temperature in the evaporator is too low ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Empty the refrigerant circuit, renew all reservoirs/receivers with dryer or desiccant cartridge, and then evacuate the refrigerant circuit for at least 3 hours ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and  
⇒ "2 Working with air conditioner service station", page 123 .

#### Conditions for testing

- ◆ Observe the general information on checking pressures in the refrigerant circuit  
⇒ "2.14.1 General information on checking pressures in the refrigerant circuit", page 164



## Note

*All of the conditions for testing marked with \* are pertinent to a certain vehicle and are described in the vehicle-specific workshop manual ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*

General conditions for testing (these only have an influence on the display of the pressure gauges during this measurement with the air conditioning system switched on)

- Radiator and condenser are clean (clean them if necessary).\*
- The heat insulation on the expansion valve is OK and properly installed.\*
- The poly V-belt is OK and properly tensioned. The belts for air conditioner compressor and alternator are in good condition and correctly tensioned.\*
- The drive unit for the air conditioner compressor is OK and properly installed.\*
- All air ducts, covers and seals are OK and properly installed.\*
- Diagnosis of the air conditioning system finds no faults (with the engine running and the air conditioning system switched on), no compressor deactivation conditions are shown in the measured values (only on vehicles with diagnosis "air conditioning system") \*⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of air conditioning system.
- The air flow rate through the dust and pollen filter is not impaired by dirt.\*
- All dash panel air vents are open.\*



## Note

- ◆ *Depending on the engine, the air conditioner compressor is driven by different components (belts or drive shaft). To protect these components and the engine, the pulley or the air conditioner compressor drive unit is fitted with an overload protection which is tripped if the air conditioner compressor is not operating smoothly ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).*
- ◆ *On certain versions, the radiator fan cuts in only after the pressure in the refrigerant circuit has exceeded a pre-set value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*

Other conditions for testing (these have an influence on the display of the pressure gauge with this measurement)

- The vehicle is not exposed to the sun's rays ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- Ambient temperature is above 15°C.
- The ignition is switched off.
- The air conditioner service station is connected to the refrigerant circuit





⇒ [“2.2 Connecting air conditioner service station to refrigerant circuit”, page 125](#) .

- ◆ ⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#) .
- ◆ ⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)

#### Checking pressures with the ignition switched off



##### Note

- ◆ *The switching pressures for actuation of the air conditioner compressor regulating valve - N280- , the air conditioning system magnetic clutch - N25- (if fitted) and the radiator fan (e.g. radiator fan - V7- / radiator fan 2 - V177- ) are vehicle-specific*  
⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific*  
⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ *Once the planned measures are complete, separate the air conditioner service station from the refrigerant circuit and switch it off*  
⇒ [“2.8 Switching off air conditioner service station and separating from refrigerant circuit”, page 145](#) .
- The engine is at operating temperature (at an ambient temperature less than 25°C).



##### Note

- ◆ *Should the engine not be at operating temperature, take the vehicle for a short drive.*
- ◆ *To test the cooling output, the engine does not have to be at operating temperature. However, to demand a certain cooling output from the air conditioning system at an ambient temperature of less than 25°C, the engine is required to be warm if ambient temperatures are low.*
- ◆ Observe the test prerequisites ⇒ [page 170](#) .
- On vehicles with high-voltage system, switch off “stationary air conditioning” function (deactivate)⇒ Owner's Manual and ⇒ Operating instructions of infotainment / MMI .
- Switch off ignition.
- Connect the air conditioner service station  
⇒ [“2.2 Connecting air conditioner service station to refrigerant circuit”, page 125](#) .
- Check the pressures in the refrigerant circuit with the engine stationary.
- Take pressure readings from pressure gauges of air conditioner service station . Two results may be displayed:
- ◆ The pressure in the refrigerant circuit is lower than indicated in the following table ⇒ [page 176](#) .
- ◆ The pressure in the refrigerant circuit is equal to or greater than that in the following table ⇒ [page 177](#) .



**Note**

- ◆ Vapour pressure table for R1234yf refrigerant  
⇒ ["6.1.3 Vapour pressure table for refrigerant", page 17](#)
- ◆ On vehicles with high-voltage system and auxiliary air conditioning system functions ("heat pump mode" or "cooling of high-voltage battery"), valves may be installed in the refrigerant circuit that are not open when unenergised. These valves are opened and closed e.g. via incremental motors and are no longer actuated when the ignition is switched off. Depending on the last operating status of the air conditioning system, certain areas of the refrigerant circuit could be isolated by these valves. Depending on the layout of the service connections in the refrigerant circuit, these could be in an area that is isolated (e.g. the area with the service connection on the high pressure side). If necessary, these valves must be opened before the pressure is tested ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ The pressures given in the table are slightly lower than specified in the vapour pressure table for the R1234yf refrigerant. The evaporation pressure of the refrigerant in the refrigerant circuit is orientated around the coldest component and could therefore also be slightly lower in a correctly charged refrigerant circuit than that specified for the R1234yf refrigerant in the vapour pressure table.

Ambient temperature (in degrees C)	Pressure in the refrigerant circuit in bar positive pressure
+15 °C	3.5
+20 °C	4.4
+25 °C	5.3
+30 °C	6.3
+35 °C	7.4
+40 °C	8.6
+45 °C	10.0



#### Note

- ◆ *The temperature of the components of the refrigerant circuit should be the same as the ambient temperature. If individual components of the refrigerant circuit are warmer or colder, the pressure will deviate from the values shown in the tables.*
- ◆ *Absolute pressure means that 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute pressure. On most pressure gauges, a reading of 0 bar corresponds to an absolute pressure of one bar (which is confirmed by the existence of a -1 bar marking beneath the 0 scale marking).*
- ◆ *On vehicles with pressure senders ( high pressure sender - G65- , pressure sender for refrigerant circuit - G805- or refrigerant pressure and temperature sender - G395- , etc.) for which the measured pressure is displayed in the measured values of the diagnosis, the measured pressure should correlate with the values in the table (or be slightly higher) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system, and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *The pressure is given in different units, 1 MPa (megapascal) equates to 10 bar overpressure or 145 psi. At 0 bar overpressure, 1 bar absolute pressure is approximately the same as ambient pressure (atmospheric pressure).*

If the measured values are OK and there is no complaint:

- Unscrew (close) the handwheels of the quick-release coupling adapters ⇒ Operating instructions air conditioner service station .
- Extract the refrigerant from the two filler hoses using the air conditioner service station as instructed in the relevant operating manual ⇒ Operating instructions air conditioner service station .
- Switch off the air conditioner service station (and isolate it from the power supply if necessary)  
⇒ "2.8 Switching off air conditioner service station and separating from refrigerant circuit", page 145 .

If the measured values are OK and there is complaint:

- Check the cooling output of the air conditioning system ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and watch the pressures in the refrigerant circuit.
- ◆ ⇒ "2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor", page 177 .
- ◆ ⇒ "2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199

If the measured values are not OK:

- Investigate the cause of the deviation and rectify.



## Note

- ◆ If the pressures are too low, it could be because there is too little refrigerant in the circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual) and ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
- ◆ If the pressures are too high, there may be too much refrigerant or refrigerant oil in the circuit. Empty the refrigerant circuit using the air conditioner service station  
⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) . If the extracted refrigerant volume is greater than the specified fill capacity for the R1234yf refrigerant ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), evacuate the refrigerant circuit and recharge with the correct amount of R1234yf refrigerant. Then repeat the test. If the extracted quantity of refrigerant roughly equates to the specified fill capacity for the R1234yf refrigerant or is less, clean the refrigerant circuit with refrigerant  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) . Then add the specified amount of refrigerant oil, evacuate the refrigerant circuit, recharge with the correct volume of R1234yf refrigerant and repeat the test.
- ◆ If the pressures are too low or too high and contaminated refrigerant is found during the gas analysis, this may be the cause of the deviation (different refrigerants have varying vapour pressures). Empty the refrigerant circuit and then clean with R1234yf refrigerant  
⇒ [“2.3 Performing gas analysis of refrigerant”, page 128](#) ,  
⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) and  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#)

## The pressure in the refrigerant circuit is lower than indicated in the table

Too little refrigerant in circuit.

- Check for leaks in the refrigerant circuit  
⇒ [“1.4 Investigating leaks”, page 67](#) .
- Check the high pressure safety valve  
⇒ [“1.2.17 High-pressure safety valve”, page 52](#)

If the high pressure safety valve has blown (check ⇒ [“1.2.17 High-pressure safety valve”, page 52](#) ):

- Check radiator fan actuation or the radiator fan ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
- On vehicles with shut-off valves for the refrigerant circuit, check the actuation and function of these shut-off valves ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system (and battery control) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check refrigerant lines and refrigerant hoses for signs of crushing (bottle-neck), external damage and tight bends ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If no fault can be detected, clean the refrigerant circuit  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .



The pressure in the refrigerant circuit is equal to or greater than that in the table

- ◆ ⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#) .
- ◆ ⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)

## 2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor

Checking pressures ⇒ [page 177](#)

Specifications for pressures in the refrigerant circuit  
⇒ [page 181](#)

### Checking pressures

Refrigerant circuit with expansion valve, receiver with or without air conditioning system magnetic clutch - N25- and air conditioner compressor regulating valve - N280- (with externally regulated air conditioner compressor)



#### Note

- ◆ *Connect the air conditioner service station  
⇒ [“2.2 Connecting air conditioner service station to refrigerant circuit”, page 125](#) .*
- ◆ *If on vehicles with two evaporators a problem is encountered in just one evaporator, check the pressures in the refrigerant circuit. If these are OK, check the line connection between the evaporator that is causing the problem and the outlet of the line connection at the distribution point of the refrigerant lines (for bottle-neck or blockage). If no fault can be determined, empty the refrigerant circuit and recharge with the prescribed amount of refrigerant. Then check the pressures and the cooling output of the air conditioner again. If the problem persists, replace the expansion valve upstream of the problematic evaporator ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ ⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 170](#)

### Conditions for testing

- The air conditioner service station is connected to the refrigerant circuit  
⇒ [“2.2 Connecting air conditioner service station to refrigerant circuit”, page 125](#) .
- Observe the conditions for testing pressures in the refrigerant circuit with the ignition switched off ⇒ [page 170](#) .
- The pressures in the refrigerant circuit comply with the specifications with the ignition switched off  
⇒ [“2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off”, page 170](#) .
- Observe the conditions for testing the cooling output ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).



## Note

- ◆ *The switching pressures for actuation of the air conditioner compressor regulating valve - N280- , the air conditioning system magnetic clutch - N25- (if fitted) and the radiator fan - V7- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- The engine is at operating temperature (at an ambient temperature less than 25°C).



## Note

- ◆ *Should the engine not be at operating temperature, take the vehicle for a short drive.*
- ◆ *To test the cooling output, the engine does not have to be at operating temperature. However, to demand a certain cooling output from the air conditioning system at an ambient temperature of less than 25°C, the engine is required to be warm if ambient temperatures are low.*
- Start engine.
- Set the air conditioning system to maximum cooling output ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- The air conditioner compressor is actually driven with the engine running (visual check ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)).
- The air conditioner compressor regulating valve - N280- is actuated ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.



## Note

- ◆ *Depending on the engine, the air conditioner compressor is driven by different components (belts or drive shaft). To protect these components and the engine, the pulley or the air conditioner compressor drive unit is fitted with an overload protection which is tripped if the air conditioner compressor is not operating smoothly ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).*
- ◆ *On vehicles with air conditioner compressor regulating valve - N280- , the control current can be gleaned from the measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*

If the air conditioner compressor is not driven or the regulating valve not activated when the engine is running:

- Determine the cause, e.g. by interrogating the event memory of the air conditioning system, and rectify it ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.



- If fitted, check the voltage supply for the air conditioning system magnetic clutch - N25- . If this is OK, repair the magnetic clutch ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check actuation of the air conditioner compressor regulating valve - N280- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.



#### Note

- ◆ *On air conditioner compressors with an air conditioning system magnetic clutch - N25- , the air conditioner compressor only works (delivers refrigerant) if in addition to the air conditioner compressor regulating valve - N280- , -N25- is actuated ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *-N280- (and -N25- ) is actuated by the air conditioning system control unit - J301- , the operating and display unit for front air conditioning system - E87- and the Climatronic control unit - J255- or a downstream control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *All of the conditions for testing marked with \* are pertinent to a certain vehicle and are described in the vehicle-specific workshop manual ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- The radiator and condenser are clean (clean if necessary) \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- The heat insulation on the expansion valve is OK and mounted correctly \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- The poly V-belt is OK and properly tensioned. The belts for air conditioner compressor and alternator are in good condition and correctly tensioned.\* ⇒ Heating, air conditioning system; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual) and ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- The drive unit for the air conditioner compressor is OK and mounted properly \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
- The air ducts, covers and seals are OK and mounted correctly \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- Diagnosis of the air conditioning system finds no faults (with the engine running and the air conditioning system switched on), no compressor deactivation conditions are shown in the measured values of the respective control unit (only on vehicles with diagnosis "air conditioning system").\* ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode of air conditioning system.
- The air flow rate through the dust and pollen filter is not impaired by dirt.\* ⇒ Heating, air conditioning system; Rep. gr.





87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

- The heater and air conditioner does not draw any secondary air at highest fresh air blower speed. The evaporator and heater are not drawing in secondary air at the highest fresh air blower speed \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- The air flaps in the heating and air conditioning unit, in the heating and in the evaporator reach their end position \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- The fresh air intake ducts under the bonnet and in the passenger compartment and the corresponding water drain valves are OK \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- Engine warm.
- The vehicle is not exposed to the sun's rays ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- Ambient temperature is above 15°C.
- All dash panel diffusers are open \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Air duct system (vehicle-specific workshop manual).

Setting e.g. on operating and display unit for front air conditioning system - E87- and Climatronic control unit - J255- or air conditioning system control unit - J301- (and operating and display unit for rear Climatronic - E265- on vehicles with two heating and air conditioning units) \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

Setting on -E87- / -J255- \*: ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

- Select “Auto” mode (air conditioner compressor switched on).
- Set temperature to “cold” or “LO” for the driver and front passenger side (and the rear on the left and right in vehicles with two heating and air conditioning units).

Setting on -J301- \*:

- Press A/C button and Rec or recirculate buttons.
- Turn rotary temperature knob in direction of “cold” stop.
- Set rotary fresh air blower switch to “4” (maximum fresh air blower speed).

The following conditions for testing should then be met in the system:

- The radiator fan - V7- is running or the radiator fan - V7- and radiator fan 2 - V177- are running (at least stage 1) \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Check-



ing cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

### Note

*On certain versions, the radiator fan cuts in only after the pressure in the refrigerant circuit has exceeded a pre-set value ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*

- The fresh air blower - V2- (and the rear fresh air blower - V80- on vehicles with two heating and air conditioning units) is running at maximum speed.\*
- The coolant shut-off valve is closed \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- The valves of the pump-valve unit are closed and the coolant circulation pump is not delivering \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- The fresh air blower - V2- (and the rear fresh air blower - V80- on vehicles with two heating and air conditioning units) is running at maximum speed.\*
- The air recirculation flap/fresh air flap is in "recirculation mode" (within 1 minute after starting the vehicle, the air flow flap closes and the air recirculation flap opens).\*
- The coolant shut-off valve is closed.\*
- The valves for the pump-valve unit are closed and the coolant circulation pump is not delivering.\*

### Specifications for pressures in the refrigerant circuit

- ◆ Observe the conditions for testing and the pressures ⇒ [page 177](#) .

### Testing:

- Raise engine speed to 2000 rpm.
- Observe pressure display (e.g. pressure gauge) of air conditioner service station ⇒ Operating instructions of air conditioner service station .

### Note

- ◆ *The switching pressures for actuation of the air conditioner compressor regulating valve - N280- and the radiator fan are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*



**High-pressure side:**

Rising from starting pressure (when pressure gauge is connected) to maximum 20 bar.

**Low-pressure side:**

From the output pressure (when connecting the pressure gauge) dropping to a value of between 1.5 and 2.3 bar absolute pressure (depending on required cooling output).





## Note

- ◆ *In the event of a very high cooling output (e.g. at high outside temperatures and high fresh air blower speed while the engine is running slowly), the air conditioner compressor is initially incapable of changing the pressure on the low pressure side to the specified level (e.g. for a certain period after switching on the air conditioning system). The air conditioner compressor is actuated with the maximum specified control current. However, the delivery volume of the air conditioner compressor is not enough under these operating conditions and at this engine speed to lower the pressure on the low pressure side to the specification. One way of checking the regulating behaviour of the air conditioner compressor under these conditions is to actuate e.g. the fresh air blower with only approx. 40% of the maximum voltage and to check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair information; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *If the demand on the cooling output is low (e.g. at an ambient temperature of 20°C and a low fresh air blower speed), pressure on the high pressure side may only increase up to a value of 6 to 7 bar (the energy exchange is low, the refrigerant is cooled down quickly in the condenser). To check the regulating behaviour and the pressures in the refrigerant circuit under these conditions, e.g. actuate the fresh air blower with maximum voltage, set the air conditioning system to maximum heating output and activate air recirculation ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *Under unfavourable conditions (very high ambient temperatures, high atmospheric humidity), the pressure on the high pressure side can increase to a maximum of 29 bar.*
- ◆ *The specified working current for the air conditioner compressor regulating valve - N280- is displayed as a measured value by the operating and display unit for front air conditioning system - E87- , the air conditioning system control unit - J301- and the Climatronic control unit - J255- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *The high pressure measured by the high pressure sender - G65- , the pressure sender for refrigerant circuit - G805- and the refrigerant pressure and temperature sender - G395- is displayed as a measured value by -E87- , -J301- or -J255- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *The low pressure adjusts depending on the control current for the air conditioner compressor regulating valve - N280- and the control characteristic of the expansion valve within the performance band of the air conditioner compressor in the tolerance range ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *In unfavourable conditions (very high ambient temperatures, high air humidity), the performance of the air conditioner compressor may not always be enough to reach the specified pressure value within the given time (it could take slightly longer, depending on the engine speed, for the prescribed low pressure to be reached).*



- ◆ *If the air conditioner compressor's capacity utilisation is above 90%, pressure on the low pressure side could be higher than the specified tolerance range. The air conditioner compressor output is no longer sufficient in the prevailing conditions (ambient temperature, air humidity, setting of the air conditioning system, engine speed, etc.) to change the pressure on the low pressure side to approx. 2 bar.*
- ◆ *The specified working current for the air conditioner compressor regulating valve - N280- must be higher than 0.3 A so that -N280- can be actuated reliably ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *When setting to "maximum cooling output", the control current for the air conditioner compressor regulating valve - N280- is regulated at approx. 0.65 A (to 0.85 A). This measured value is vehicle-specific and is displayed in the ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *Absolute pressure means that 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute. On most pressure gauges, a reading of 0 bar corresponds to an absolute pressure of 1 bar (which is confirmed by the existence of a -1 bar marking beneath the 0 scale marking). Depending on the respective control unit version, pressure can be displayed as a measured value based on absolute or relative pressure (difference between displays 1 bar) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *The temperature of the air after the evaporator, the current air conditioner compressor speed and the pressure of the refrigerant on the high pressure side along with the specified working current for the air conditioner compressor regulating valve - N280- are displayed e.g. as a measured value by the operating and display unit, the Climatronic control unit - J255- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*

Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"><li>◆ The required cooling output is not reached.</li><li>◆ High pressure remains constant or increases only slightly (above the pressure measured when the engine is stationary).</li><li>◆ Low pressure drops quickly to the specification or lower.</li></ul>	⇒ <a href="#">page 186</a>
<ul style="list-style-type: none"><li>◆ The required cooling output is not reached.</li><li>◆ The high pressure equates to the specification</li><li>◆ The low pressure equates to the specification or is too low</li></ul>	⇒ <a href="#">page 187</a>



Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"> <li>◆ The requisite cooling output is not reached.</li> <li>◆ High pressure does not increase or only marginally above the pressure with the engine stationary</li> <li>◆ The low pressure does not drop or only marginally</li> </ul>	⇒ <a href="#">page 188</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output is not reached.</li> <li>◆ The high pressure increases beyond the specified value</li> <li>◆ Low pressure drops quickly to the specification or lower.</li> </ul>	⇒ <a href="#">page 189</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output is reached initially but after a while or after an extended period, the cooling output is no longer sufficient.</li> <li>◆ The high pressure and the low pressure are normal to start with</li> <li>◆ After some time, the high pressure rises above the specification, the low pressure still equates to the specification or it drops below the specification.</li> </ul>	⇒ <a href="#">page 190</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output is reached initially but after a short or extended period, the required level is no longer reached.</li> <li>◆ The high pressure and low pressure are normal to start with but after a while, the high pressure rises above the specification and the low pressure drops to the specification or lower.</li> <li>◆ The high pressure and low pressure are normal to start with. After a while, the low pressure drops to the specification or lower and the evaporator ices up.</li> </ul>	⇒ <a href="#">page 192</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output is reached.</li> <li>◆ The high pressure equates to the specification</li> <li>◆ The low pressure is too low (lower than the specification)</li> </ul>	⇒ <a href="#">page 193</a>
<ul style="list-style-type: none"> <li>◆ The air conditioner compressor is noisy (especially immediately after being switched on),</li> <li>◆ The requisite cooling output is reached.</li> <li>◆ High pressure normal or too high</li> <li>◆ The low pressure is normal or too high (the specification is not always reached)</li> </ul>	⇒ <a href="#">page 195</a>





Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"> <li>◆ The required cooling output is not reached.</li> <li>◆ The high pressure and low pressure equate to the specification</li> </ul>	⇒ <a href="#">page 197</a>

Possible deviation from specification during pressure test
<ul style="list-style-type: none"> <li>◆ The required cooling output is not reached.</li> <li>◆ High pressure remains constant or increases only slightly (above the pressure measured when the engine is stationary).</li> <li>◆ The low pressure does not drop or only marginally</li> </ul>
Possible causes for deviation from specification and rectification
<ul style="list-style-type: none"> <li>◆ Actuation of the air conditioner compressor regulating valve - N280- is defective. <ul style="list-style-type: none"> <li>– Check actuation of the air conditioner compressor regulating valve - N280- and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.</li> </ul> </li> <li>◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor defective <ul style="list-style-type: none"> <li>– Check function of -N280- ; if necessary remove -N280- and check for dirt ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ <a href="#">page 78</a></li> <li>– -N280- or renew the air conditioner compressor ⇒ <a href="#">page 78</a></li> <li>– If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or renew the receiver/reservoir) ⇒ <a href="#">page 78</a> and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) as well as ⇒ <a href="#">"1.6 Cleaning refrigerant circuit", page 91</a> .</li> </ul> </li> </ul>
Final measures
<ul style="list-style-type: none"> <li>– Recharge the refrigerant circuit ⇒ <a href="#">"2.6 Charging refrigerant circuit", page 140</a></li> <li>– Repeat the test ⇒ <a href="#">"2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor", page 177</a></li> </ul>



## Note

- ◆ If this problem is encountered, ensure that the air conditioner compressor (air conditioner compressor shaft) is actually being driven via the pulley/drive unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ If no fault can be found for this complaint, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .
- ◆ Check the measured values of the evaporator output temperature sender - G263- and actuation of -N280- . If the measured value of -G263- is faulty, the evaporator could ice up or the cooling output may not be reached ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
- ◆ If, after repeating the test when the expansion valve has been renewed, the air conditioning system is not operating correctly, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) . Then renew the air conditioner compressor and desiccant cartridge (or reservoir/receiver) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.
- ◆ If the expansion valve is defective (always closed or not opening wide enough), -N280- will change to maximum power and the low pressure will fall to the diagram value or less (the air conditioner compressor is drawing the refrigerant out of the low pressure side) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system. However, since no refrigerant can flow through the expansion valve, the required cooling output is not reached, the high pressure may also not rise or only marginally since no energy exchange is taking place.

### Possible deviation from specification during pressure test

- ◆ The required cooling output is not reached.
- ◆ The high pressure equates to the specification
- ◆ The low pressure equates to the specification or is too low

### Possible causes for deviation from specification and rectification

- ◆ There is too little refrigerant in the refrigerant circuit.
- ◆ The expansion valve is defective.
  - Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
  - If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
  - The extracted refrigerant volume approximately equates to the prescribed fill volume, renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)

### Final measures



### Possible deviation from specification during pressure test

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat the test  
⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#)



### Note

- ◆ *Check the measured values of the evaporator output temperature sender - G263- and actuation of -N280-. If the measured value of -G263- is faulty, the evaporator could ice up or the cooling output may not be reached ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.*
- ◆ *If, after repeating the test when the expansion valve has been renewed, the air conditioning system is not operating correctly, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) . Then renew the air conditioner compressor and reservoir/receiver (or desiccant cartridge) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output is not reached.
- ◆ High pressure does not increase or only marginally above the pressure with the engine stationary
- ◆ The low pressure does not drop or only marginally

### Possible causes for deviation from specification and rectification

- ◆ The air conditioner compressor is not driven or not driven at the specified speed
  - Check the drive of the air conditioner compressor (via belts or drive unit) ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
- ◆ Actuation of the air conditioner compressor regulating valve - N280- (the air conditioning system magnetic clutch - N25- ) is defective.
  - Check actuation of the air conditioner compressor regulating valve - N280- (and the air conditioning system magnetic clutch - N25- ) and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor defective
  - Check function of -N280- ; if necessary remove -N280- and check for dirt ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and ⇒ [page 78](#)
  - -N280- or renew the air conditioner compressor ⇒ [page 78](#)
  - If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or renew the receiver/reservoir) ⇒ [page 78](#) , ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
- ◆ Bottle-neck or blockage in refrigerant circuit (e.g. in refrigerant line between service connection on “low pressure side” and air conditioner compressor).
  - Touch the refrigerant circuit by hand to feel for a drop in temperature ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). If a drop in temperature is felt on a component, if there is a kink or bottle-neck in the hose or pipeline, renew this component. In the event of a blockage or if no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#)
- Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures



#### Possible deviation from specification during pressure test

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat the test  
⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#)



#### Note

- ◆ *If this problem is encountered, ensure that the air conditioner compressor (air conditioner compressor shaft) is actually being driven via the pulley / drive unit (take note of overload safety device) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *On certain engines, air conditioner compressors are used that feature in addition to -N280- an air conditioning system magnetic clutch - N25- on the belt pulley. In the event of this problem, make sure that -N25- is actually being actuated and that the air conditioner compressor (air conditioner compressor shaft) is being driven by the pulley ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Electronic parts catalogue .*
- ◆ *If no fault can be found for this complaint, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .*
- ◆ *Check the measured values of the evaporator output temperature sender - G263- and actuation of -N280- . If the measured value of -G263- is faulty, the evaporator could ice up or the cooling output may not be reached ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.*
- ◆ *If, after repeating the test when the expansion valve has been renewed, the air conditioning system is not operating correctly, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) . Then renew the air conditioner compressor and reservoir/receiver (or desiccant cartridge) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *If the expansion valve is defective (always closed or not opening wide enough), -N280- will change to maximum power and the low pressure will fall to the diagram value or less (the air conditioner compressor is drawing the refrigerant out of the low pressure side) ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system. However, since no refrigerant can flow through the expansion valve, the required cooling output is not reached, the high pressure may also not rise or only marginally since no energy exchange is taking place.*

#### Possible deviation from specification during pressure test

- ◆ The requisite cooling output is not reached.
- ◆ The high pressure increases beyond the specified value
- ◆ Low pressure drops quickly to the specification or lower.

#### Possible causes for deviation from specification and rectification





### Possible deviation from specification during pressure test

- ◆ Actuation of the air conditioner compressor regulating valve - N280- is defective.
  - Check the actuation of -N280- and, if necessary, repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
- ◆ Constriction or obstruction in refrigerant circuit
- ◆ Expansion valve defective
- ◆ If a shut-off valve is installed in the refrigerant circuit and it does not open correctly or at all ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Touch the refrigerant circuit by hand to feel for a drop in temperature ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). If a drop in temperature is felt on a component, if there is a kink or bottle-neck in the hose or pipeline, renew this component. In the event of a blockage or if no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#)
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat the test  
⇒ ["2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor", page 177](#)



### Note

- ◆ *In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.*
- ◆ *If the expansion valve is defective (always closed or not opening wide enough) the air conditioner compressor regulating valve - N280- will be set to maximum power and the low pressure value will fall to the diagram value or less (the air conditioner compressor extracts refrigerant from the low pressure side). Since no refrigerant can flow through the expansion valve, however, the cooling output is not reached and the high pressure may also not increase or only increase slightly owing to there being no energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *If there is too much refrigerant in the refrigerant circuit, the air conditioner compressor must be emptied and the desiccant bag (desiccant cartridge) or reservoir/receiver renewed. After cleaning (flushing with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) the refrigerant circuit, pour the correct volume of refrigerant oil in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; Approved refrigerant oils and refrigerant oil fill volumes (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *If the specification is not reached again when the test is repeated but no fault can be found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .*



### Possible deviation from specification during pressure test

- ◆ The requisite cooling output is reached initially but after a while or after an extended period, the cooling output is no longer sufficient.
- ◆ The high pressure and the low pressure are normal to start with
- ◆ After some time, the high pressure rises above the specification, the low pressure still equates to the specification or it drops below the specification.

### Possible causes for deviation from specification and rectification

- ◆ Radiator, condenser contaminated or actuation of the radiator is not OK
  - Check actuation of the radiator fan and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
  - Check condenser for contamination and clean if necessary ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Engine, mechanicals; Rep. gr. 19 ; Radiator/ radiator fan .
- ◆ Actuation of the air conditioner compressor regulating valve - N280- is defective.
  - Check actuation of -N280- and the measured value of evaporator output temperature sender - G263- , repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
- ◆ Too much refrigerant in the refrigerant circuit
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably greater (more than 100 g) than the prescribed fill volume ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there was too much refrigerant in the refrigerant circuit Refill the refrigerant circuit with the correct volume of R1234yf and repeat the test.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor defective
  - Check function of -N280- ; if necessary remove -N280- and check for dirt ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and ⇒ [“1.5 Renewing components”, page 78](#)
  - -N280- or renew the air conditioner compressor ⇒ [“1.5 Renewing components”, page 78](#)
  - If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or renew the receiver/reservoir) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
- ◆ Too much refrigerant oil in the refrigerant circuit
- ◆ Moisture in refrigerant circuit
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there is too much refrigerant oil in the refrigerant circuit
  - Clean refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat the test  
⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#)





## Note

- ◆ If there is too much refrigerant in the refrigerant circuit, the air conditioner compressor must be emptied and the desiccant bag (desiccant cartridge) or reservoir/receiver renewed. After cleaning (flushing with R1234yf refrigerant) ⇒ **"1.6 Cleaning refrigerant circuit", page 91** the refrigerant circuit, pour the correct volume of refrigerant oil in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; Approved refrigerant oils and refrigerant oil fill volumes (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.
- ◆ A fault in the evaporator output temperature sender - G263- could also cause the refrigerant circuit to ice up. With this complaint, also observe the measured value of -G263- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output is reached initially but after a short or extended period, the required level is no longer reached.
- ◆ The high pressure and low pressure are normal to start with but after a while, the high pressure rises above the specification and the low pressure drops to the specification or lower.
- ◆ The high pressure and low pressure are normal to start with. After a while, the low pressure drops to the specification or lower and the evaporator ices up.

### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ Radiator, condenser contaminated or actuation of the radiator is not OK
  - Check actuation of the radiator fan and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
  - Check condenser for contamination and clean if necessary ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Engine, mechanicals; Rep. gr. 19 ; Radiator/ radiator fan .
- ◆ Measured value of evaporator output temperature sender - G263- faulty.
  - Check measured value and installation of -G263- ⇒ Vehicle diagnostic tester in “Guided Fault Finding” function - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
- ◆ Actuation of the air conditioner compressor regulating valve - N280- is defective.
  - Check actuation of the air conditioner compressor regulating valve - N280- and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor defective
  - Check function of -N280- ; if necessary remove -N280- and check for dirt ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and ⇒ [“1.5 Renewing components”, page 78](#)
  - -N280- or renew the air conditioner compressor ⇒ [“1.5 Renewing components”, page 78](#)
  - If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or renew the receiver/reservoir) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) , ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Moisture in refrigerant circuit
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - Clean refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat the test  
⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#)



### Note

- ◆ *In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.*
- ◆ *A fault in the evaporator output temperature sender - G263- could cause the refrigerant circuit to ice up. With this complaint, also observe the measured value of -G263- .*
- ◆ *If there is too much moisture in the circuit, the air conditioner compressor must be emptied and the desiccant bag/desiccant cartridge (or reservoir/receiver) renewed. After cleaning (flushing with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) the refrigerant circuit, pour the correct volume of refrigerant oil in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*



#### Possible deviation from specification during pressure test

- ◆ The requisite cooling output is reached.
- ◆ The high pressure equates to the specification
- ◆ The low pressure is too low (lower than the specification)

#### Possible causes for deviation from specification and rectification

- ◆ Measured value of evaporator output temperature sender - G263- faulty.
  - Check measured value and installation of -G263- ⇒ Vehicle diagnostic tester in "Guided Fault Finding" function - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- ◆ Actuation of the air conditioner compressor regulating valve - N280- is defective.
- ◆ If a shut-off valve is installed in the refrigerant circuit and it does not open correctly or at all ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Check actuation of the air conditioner compressor regulating valve - N280- and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit .
- ◆ Air conditioner compressor regulating valve - N280- or air conditioner compressor defective
  - Check function of -N280- ; if necessary remove -N280- and check for dirt ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ ["1.5 Renewing components", page 78](#)
  - -N280- or renew the air conditioner compressor ⇒ ["1.5 Renewing components", page 78](#)
  - If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or renew the receiver/reservoir) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) , ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

#### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat the test  
⇒ ["2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor", page 177](#)



## Note

- ◆ In the event of the following fault "High pressure normal, low pressure too low", please note the following: With this fault, there is a chance that the evaporator could ice up even though the refrigerant volume in the circuit is OK.
- ◆ If the fault exists in a shut-off valve that may be installed in the system (shut-off valve does not open), the refrigerant circuit needs to be cleaned (flushed with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ). With this fault, it is sufficient to check actuation of the shut-off valve. If this is OK, renew the shut-off valve.
- ◆ If the fault is in the air conditioner compressor regulating valve - N280- (the regulating valve is not activated, but the air conditioner compressor still runs), it is not necessary to clean the refrigerant circuit (flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ). In this case it is sufficient to renew the air conditioner compressor (observe quantity of refrigerant oil in compressor).
- ◆ If the expansion valve is defective (always closed or not opening wide enough) the air conditioner compressor regulating valve - N280- will be set to maximum power and the low pressure value will fall to the diagram value or less (the air conditioner compressor extracts refrigerant from the low pressure side). However, since no refrigerant can flow through the expansion valve, the required cooling output is not reached, the high pressure may also not rise or only marginally since no energy exchange is taking place. With this fault, it is not necessary to clean the refrigerant circuit (flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ). Renewing the expansion valve is sufficient.
- ◆ Check the measured values of the evaporator output temperature sender - G263- and actuation of the air conditioner compressor regulating valve - N280- . If the measured value of -G263- is faulty, the evaporator could ice up or the cooling output may not be reached ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.

### Possible deviation from specification during pressure test

- ◆ The air conditioner compressor is noisy (especially immediately after being switched on),
- ◆ The requisite cooling output is reached.
- ◆ High pressure normal or too high
- ◆ The low pressure is normal or too high (the specification is not always reached)

### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ Actuation of the air conditioner compressor regulating valve - N280- is defective.
  - Check actuation of the air conditioner compressor regulating valve - N280- and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.
- ◆ Check function of -N280- ; if necessary remove -N280- and check for dirt ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (workshop manual for specific vehicle).
- ◆ Renew -N280- or air conditioner compressor ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
- ◆ If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or renew the receiver/reservoir) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) , ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Too much refrigerant or refrigerant oil in the refrigerant circuit
  - Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
  - If the extracted refrigerant volume is considerably greater (more than 100 g) than the prescribed fill volume ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there was too much refrigerant in the refrigerant circuit Recharge refrigerant circuit and repeat test.
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally higher than the prescribed fill volume (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there is too much refrigerant oil in the refrigerant circuit Clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) , recharge with the correct volume of refrigerant and refrigerant oil and repeat the test.
- ◆ Expansion valve defective
  - If a shut-off valve is installed in the refrigerant circuit and it does not open correctly or at all ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The air conditioner compressor is defective.
  - If it is not possible to find a fault on any of the components and the extracted refrigerant volume equates to the specifications, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) . If when cleaning the refrigerant circuit no overly high volume of refrigerant is found, renew the air conditioner compressor ⇒ ["1.5 Renewing components", page 78](#) , ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat the test  
⇒ ["2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor", page 177](#)





## Note

- ◆ *The cause for this fault could also be too much refrigerant oil in the refrigerant circuit. Overfilling with refrigerant oil can occur if the refrigerant oil level was not checked after the air conditioner compressor was renewed. If there is too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant).  
⇒ "1.6 Cleaning refrigerant circuit", page 91*
- ◆ *If the expansion valve (or a shut-off valve that may be installed in the system) is defective (always closed or not opening wide enough) the air conditioner compressor regulating valve - N280- will be set to maximum power and the low pressure value will fall to the diagram value or less (the air conditioner compressor extracts refrigerant from the low pressure side). Since no refrigerant can flow through the expansion valve, however, the cooling output is not reached and the high pressure may also not increase or only increase slightly owing to there being no energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

### Possible deviation from specification during pressure test

- ◆ The required cooling output is not reached.
- ◆ The high pressure and low pressure equate to the specification

### Possible causes for deviation from specification and rectification







## Possible deviation from specification during pressure test

- ◆ There is too little refrigerant in the refrigerant circuit.
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ [“1.4 Investigating leaks”, page 67](#)
  - The extracted refrigerant volume roughly equates to the prescribed fill volume, measured value of evaporator output temperature sender - G263- , actuation of air conditioner compressor regulating valve - N280- , function of expansion valve faulty or fault in a different component (see below).
- ◆ Measured value of evaporator output temperature sender - G263- faulty.
  - Check measured value and installation of -G263- ⇒ Vehicle diagnostic tester in “Guided Fault Finding” function - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
- ◆ Actuation of the air conditioner compressor regulating valve - N280- is defective.
  - Check the actuation of -N280- and, if necessary, repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
- ◆ Expansion valve defective
- ◆ If a shut-off valve is installed in the refrigerant circuit and it does not open correctly or at all ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Touch the refrigerant circuit by hand to feel for a drop in temperature ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). If a drop in temperature is felt on a component, if there is a kink or bottle-neck in the hose or pipeline, renew this component. In the event of a blockage or if no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#)
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Too much refrigerant oil in the refrigerant circuit
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally higher than the prescribed fill volume (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there is too much refrigerant oil in the refrigerant circuit Clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) , recharge with the correct volume of refrigerant and refrigerant oil and repeat the test.
- ◆ Expansion valve defective
- ◆ If a shut-off valve is installed in the refrigerant circuit and it does not open correctly or at all ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

## Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat the test  
⇒ [“2.14.4 Checking pressures with air conditioning system switched on - vehicles with mechanical air conditioning compressor”, page 177](#)



#### Note

- ◆ Check the measured values of the evaporator output temperature sender - G263- and actuation of -N280-. If the measured value of -G263- is faulty, the evaporator could ice up or the cooling output will not be reached ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- ◆ Overfilling with refrigerant oil can occur if the refrigerant oil level was not checked after the air conditioner compressor was renewed.
- ◆ If the expansion valve is defective (always open) the evaporator temperature will no longer be controlled so that only gaseous refrigerant exits the evaporator. It is then possible that under certain operating conditions, drops of liquid will be drawn into the air conditioner compressor, which will then cause noise (because liquid is incompressible).
- ◆ If there is too much refrigerant oil in the circuit, empty the air conditioner compressor and, if fitted, renew the reservoir/receiver (or desiccant cartridge) ⇒ Heating, air conditioning system; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). After cleaning the refrigerant circuit (flushing with R1234yf refrigerant)  
⇒ **"1.6 Cleaning refrigerant circuit", page 91** , pour the correct amount of refrigerant oil in the circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).

## 2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor

Checking pressures ⇒ **page 199**

Specifications for pressures in refrigerant circuit on vehicles without heat pump ⇒ **page 204**

Specifications for pressures in refrigerant circuit on vehicles with heat pump ⇒ **page 228**

Checking pressures



#### Note

Work on the refrigerant circuit that involves the air conditioner service station (checking the pressures in this case) can usually be carried out without the need to de-energise the high-voltage system.

- To minimise the number of automatic engine starts during testing and measuring while operational readiness is active, charge the vehicle batteries e.g. with battery charger 60A - VAS 5904- in battery back-up mode ⇒ Electrical system; Rep. gr. 27 ; Battery; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .
- For test and measurement work that requires the vehicle's drive system to be active (READY) or the ignition to be switched on, move the selector lever to position "P", activate the



parking brake and arrange the tools needed so that they cannot come into contact with moving components of the engine and so that they cannot even come near to components that turn when the engine is running.



#### Note

- ◆ *Also move the selector lever to position "P", and activate the parking brake before performing test and measurement work for which the ignition must be switched on but where the vehicle's drive system does not need to be active (READY).*
- ◆ *Operational readiness (vehicle's drive system) is displayed in the control unit in dash panel insert - J285- via the "Powermeter" ⇒ owner's manual.*
- ◆ *Activating and deactivating vehicle drive system ⇒ Owner's manual (observe display in control unit in dash panel insert - J285- while doing so).*
- On vehicles with high-voltage system, switch off "stationary air conditioning" function (deactivate)⇒ Owner's Manual and ⇒ Operating instructions of infotainment / MMI .
- Switch off ignition.
- Connect the air conditioner service station  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) .



#### Note

*If a problem is encountered in just one evaporator on vehicles with two evaporators (one evaporator in the heater and air conditioning unit and one evaporator on the heat exchanger for high-voltage battery), check the pressures in the refrigerant circuit. Check the line connection between the evaporator that is causing the problem and the end of the line at the distribution point for the refrigerant lines (for a bottle-neck or blockage). If no fault can be found, empty the refrigerant circuit and recharge it with the prescribed amount of refrigerant. Then check the pressures and the cooling output of the air conditioning system again. If the problem persists, check / renew the following components: If the problem is only encountered at the evaporator in the heating and air conditioning unit, check the evaporator in the heating and air conditioning unit (it is open in unactuated state and allows refrigerant to flow through). Renew the expansion valve on the evaporator in the heater and air conditioning unit if no fault can be found in the shut-off valve. If the problem is only encountered on the evaporator in the heat exchanger for high-voltage battery, check actuation of the shut-off valve on the expansion valve on the evaporator in the heat exchanger for high-voltage battery (it is closed in unactuated state and does not allow refrigerant to flow through) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

#### Conditions for testing

- The air conditioner service station is connected to the refrigerant circuit  
⇒ ["2.2 Connecting air conditioner service station to refrigerant circuit", page 125](#) .
- Observe the conditions for testing pressures in the refrigerant circuit with the ignition switched off ⇒ [page 170](#) .
- The pressures in the refrigerant circuit comply with the specifications with the ignition switched off



⇒ "2.14.3 Checking pressures in the refrigerant circuit with the ignition switched off", page 170 .

- Observe the conditions for testing the cooling output ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).



**Note**

- ◆ *The switching pressures for actuation of the electrical air conditioner compressor - V470- and the radiator fan - V7- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

The engine is at operating temperature (at an ambient temperature less than 25°C).



**Note**

- ◆ *Should the engine not be at operating temperature, take the vehicle for a short drive.*
- ◆ *To test the cooling output, the engine does not have to be at operating temperature. However, to demand a certain cooling output from the air conditioning system at an ambient temperature of less than 25°C, the engine is required to be warm if ambient temperatures are low.*
- To minimise the number of automatic engine starts during testing and measuring while operational readiness is active, charge the vehicle batteries e.g. with battery charger 60A - VAS 5904- in battery back-up mode ⇒ Electrical system; Rep. gr. 27 ; Battery; Charging battery and ⇒ Electrical system; Rep. gr. 93 ; General warning instructions for work on the high-voltage system .
- Activate operational readiness (engine must not run) ⇒ owner's manual .
- Set the air conditioning system to maximum cooling output ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- The electrical air conditioner compressor - V470- is actuated and runs ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation as well as ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).



## Note

- ◆ *Actuation of the electrical air conditioning compressor is initiated by the vehicle electronics. The engine speed has no influence on the cooling output of the air conditioning system.*
- ◆ *The air conditioner compressor is currently not activated at the maximum specified speed (of approx. 8500 rpm) when the vehicle is stationary or driving slowly (up to a vehicle speed of 45 km/h). The air conditioner compressor speed is restricted to approx. 5000 rpm.*
- ◆ *Actuation of the electrical air conditioning compressor can be monitored by guided fault finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *All of the conditions for testing marked with \* are pertinent to a certain vehicle and are described in the vehicle-specific workshop manual ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*

If the air conditioner compressor is not actuated with operational readiness active:

- Determine the cause, e.g. by interrogating the event memory of the air conditioning system, and rectify it ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- The radiator and condenser are clean (clean if necessary) \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Engine, mechanicals; Rep. gr. 19 ; Radiator/radiator fan .
- The heat insulation on the expansion valve is OK and mounted correctly \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- The air ducts, covers and seals are OK and mounted correctly \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- No faults are found during diagnosis of the air conditioning system (with operational readiness (vehicle's drive system) active and the air conditioning system switched on). No compressor deactivation condition is shown in the measured valve block ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- The various pressure/temperature senders and temperature sensors on or in the refrigerant circuit supply plausible values during operation of the air conditioning system, check ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system . If no fault can be found, extract the refrigerant.
- The rate of air flow through the dust and pollen filter is not impaired by dirt \* ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- The heater and air conditioner does not draw any secondary air at highest fresh air blower speed. evaporator and heater not drawing in secondary air at maximum fresh-air blower speed \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).



- The air duct flaps in the heater and air conditioner unit, heater and evaporator reach their end position \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- Fresh-air intake ducts beneath bonnet and in passenger compartment as well as corresponding water drain valves OK\* ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).
- The vehicle is not exposed to the sun's rays ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).
- Ambient temperature is above 15°C.
- All dash panel air vents are open.\*

Setting e.g. on operating and display unit for front air conditioning system - E87- (and operating and display unit for rear air conditioning system - E265- on vehicles with two heater and air conditioning units) \* ⇒ Heating, air conditioning system; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .

Setting e.g. on -E87- \*:

- Select “Auto” mode (air conditioner compressor switched on).
- Set temperature to “cold” or “LO” for the driver and front passenger side (and the rear on the left and right in vehicles with two heating and air conditioning units).\*

Setting on -J301- \*:

- Press A/C button and Rec or recirculate buttons.\*
- Turn rotary temperature knob in direction of “cold” stop.\*
- Set rotary fresh air blower switch to “4” (maximum fresh air blower speed).\*

The following conditions for testing should then be met in the system:

- The radiator fan - V7- is running or the radiator fan - V7- and radiator fan 2 - V177- are running (at least stage 1) \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Engine, mechanicals; Rep. gr. 19 ; Radiator/radiator fan .



#### Note

*On certain versions, the radiator fan cuts in only after the pressure in the refrigerant circuit has exceeded a pre-set value ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation.*

- The fresh air blower - V2- (and the rear fresh air blower - V80- on vehicles with two heating and air conditioning units) is running at maximum speed.\*
- The air recirculation flap/fresh air flap is in “recirculation mode” (within 1 minute after starting the vehicle, the air flow flap closes and the air recirculation flap opens).\*
- The coolant shut-off valve is closed \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air





conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

- The valves of the pump-valve unit are closed and the coolant circulation pump is not delivering \* ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).



#### Note

- ◆ *Actuation of the electrical air conditioning compressor is initiated by the vehicle electronics. The engine speed has no influence on the cooling output of the air conditioning system ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *The air conditioner compressor is currently not activated at the maximum specified speed (of approx. 8500 rpm) when the vehicle is stationary or driving slowly (up to a vehicle speed of 45 km/h). The air conditioner compressor speed is restricted to approx. 5000 rpm.*
- ◆ *Actuation of the electrical air conditioning compressor can be monitored by guided fault finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

#### Specifications for pressures in the refrigerant circuit

- ◆ Specifications for pressures in refrigerant circuit on vehicles without heat pump ⇒ [page 204](#)
- ◆ Specifications for pressures in refrigerant circuit on vehicles with heat pump ⇒ [page 228](#)



#### Note

- ◆ *The specified and actual speeds for actuation of the electrical air conditioner compressor - V470- and the radiator fan - V7- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

#### Specifications for pressures in refrigerant circuit on vehicles without heat pump

- ◆ Observe the test prerequisites ⇒ [page 199](#) .
- Watch the pressure display (e.g. pressure gauge) of the air conditioner service station .



#### Note

- ◆ *The switching pressures for actuation of the electrical air conditioner compressor - V470- and the radiator fan -V7- /-V177- are vehicle-specific ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *The pressures must be measured at the service connections; the fitting locations of these connections are vehicle-specific ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

#### High-pressure side:

From the output pressure (when the pressure gauge is connected) rising up to a maximum overpressure of 20 bar (depending on the ambient temperature and operating conditions of the air conditioning system).

#### Low-pressure side:

From the output pressure (when connecting the pressure gauge) dropping to a value of between 1.5 and 2.3 bar absolute pressure (depending on required cooling output).

#### Speed of air conditioner compressor:

Between 800 and 8500 rpm depending on the required cooling output (currently maximum 5000 rpm with vehicle stationary).



## Note

- ◆ *The temperature of the air after the evaporator, the current air conditioner compressor speed and the pressure of the refrigerant on the high-pressure side are displayed as a measured value from various control units depending on the vehicle (e.g. operating and display unit, -E87-, -J255-, thermal management control unit - J1024- and air conditioning system control unit - J301-) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioner compressor and battery regulation.*
- ◆ *In the event of a very high cooling output (e.g. at high outside temperatures and high fresh air blower speed), the air conditioner compressor is initially incapable of changing the pressure on the low pressure side to the required level (e.g. for a certain period after switching on the air conditioning system). The air conditioner compressor is not activated with the max. specified (of approx. 8500 rpm), if the vehicle stands still or drives slowly (up to a vehicle speed of 45 km/h). The air conditioner compressor speed is then limited to 5000 rpm. The maximum permissible air conditioner compressor speed limit is not lifted until a vehicle speed greater than approx. 45 km/h is reached. The output (delivery rate) of the air conditioner compressor at an air conditioner compressor speed of 5000 rpm, a high ambient temperature and high fresh air blower speed (unfavourable ambient conditions) is initially no longer sufficient to bring the pressure on the low pressure side down to the specified value. To check the regulating behaviour of the air conditioner compressor under these conditions, e.g. only actuate the fresh air blower with approx. 40% of the maximum voltage and check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *If the demand on the cooling output is low (e.g. at an ambient temperature of 20°C and a low fresh air blower speed), pressure on the high pressure side may only increase up to a value of 6 to 7 bar (the energy exchange is low, the refrigerant is cooled down quickly in the condenser). To check the regulating behaviour and the pressures in the refrigerant circuit under these conditions, e.g. actuate the fresh air blower with maximum voltage, set the air conditioning system to maximum heating output and activate air recirculation ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *Under unfavourable conditions (very high ambient temperatures, high atmospheric humidity), the pressure on the high pressure side can increase to a maximum of 29 bar.*
- ◆ *The specified speed of the air conditioner compressor is displayed by various control units depending on the vehicle (e.g. operating and display unit, -E87-, -J255- and air conditioning system control unit - J301- ⇒ Vehicle diagnostic tester) in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *The high-pressure measured by various senders (e.g. high-pressure sender - G65-, pressure sender for refrigerant circuit - G805- or refrigerant pressure and temperature sender - G395-) is displayed as a measured value depending on the vehicle (e.g. by -E87-, -J301-, thermal management control unit - J1024- or -J255-) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioner compressor.*



- ◆ *The low pressure adjusts itself depending on the speed of the air conditioner compressor and the regulating characteristic of the expansion valve within the performance band of the air conditioner compressor in the tolerance range (1.5 to 2.3 over-pressure).*
- ◆ *For this test, the specified speed of the air conditioner compressor must be greater than 1500 rpm ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *For the "maximum cooling output" setting, the specified speed of the air conditioner compressor is regulated at approx. 4000 to 5000 rpm. This value is vehicle-specific and is displayed as a measured value by the respective control unit (e.g. operating and display unit, -E87-, -J255- or thermal management control unit - J1024- ➔ Vehicle diagnostic tester) in "Guided Fault Finding" mode - air conditioning system and battery regulation.*
- ◆ *Absolute pressure means that 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute. On the scales of most pressure gauges, 0 bar corresponds to an absolute pressure of 1 bar (can be seen from -1 bar mark below 0) ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system.*
- ◆ *If on a vehicle with 2 evaporators (one in the heater and air conditioner unit and one for battery cooling), the temperature measured at one evaporator meets the specification or falls below the specification, while on the other evaporator, however, the requisite specification is not reached, regulation works as follows: the respective control unit (e.g. battery regulation control unit or thermal management control unit) makes the electrical air conditioner compressor run at a higher speed via additional controls units (e.g. power and control electronics for electric drive and control unit for air conditioning compressor) (which results in the cooling output of the air conditioning system rising and pressure on the low pressure side falling along with the evaporator temperature). If the specification then falls below the minimum level at one evaporator, the respective control unit (e.g. battery regulation control unit) actuates the shut-off valves (e.g. refrigerant shut-off valve 1 or refrigerant shut-off valve 2) in such a way that the evaporator that is too cold no longer has refrigerant flowing through it ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation as well as ➔ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ➔ Heating, air conditioning; Rep. gr. 87; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).*
- ◆ *Since the output of the evaporator in the battery cooling module is considerably lower than the output of the evaporator in the heating and air conditioning unit, the requisite specified temperature in the battery cooling module may still be reached if there is insufficient refrigerant in the circuit but the specified temperature in the evaporator of the heating and air conditioning unit will no longer be reached (even though the air conditioner compressor is actuated at a higher speed) ➔ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual) and ➔ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).*



Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"><li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li><li>◆ High pressure remains constant or increases only slightly (above the pressure measured when the engine is stopped).</li><li>◆ High pressure drops quickly to the specification or lower.</li></ul>	⇒ <a href="#">page 210</a>
<ul style="list-style-type: none"><li>◆ The requisite cooling output in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling) is reached initially. However, after a while or after an extended period of operation, the cooling output is no longer adequate.</li><li>◆ The high pressure and the low pressure are normal to start with</li><li>◆ After some time, the high pressure rises above the specification, the low pressure still equates to the specification or it drops below the specification.</li></ul>	⇒ <a href="#">page 212</a>
<ul style="list-style-type: none"><li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li><li>◆ The high pressure equates to the specification</li><li>◆ The low pressure is too low (lower than the specification)</li></ul>	⇒ <a href="#">page 214</a>
<ul style="list-style-type: none"><li>◆ The air conditioner compressor is noisy (especially immediately after being switched on),</li><li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit and / or in the evaporator for battery cooling is not reached.</li><li>◆ High pressure normal or too high</li><li>◆ Low pressure too high (specification is not reached)</li></ul>	⇒ <a href="#">page 216</a>
<ul style="list-style-type: none"><li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li><li>◆ High pressure and low pressure normal (equate to specification)</li></ul>	⇒ <a href="#">page 218</a>



<b>Possible deviations from specification, cause and rectification</b>	
<ul style="list-style-type: none"> <li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li> <li>◆ The high pressure equates to the specification</li> <li>◆ The low pressure equates to the specification or is too low</li> </ul>	⇒ <a href="#">page 220</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li> <li>◆ The high pressure equates to the specification</li> <li>◆ Low pressure drops quickly to the specification or lower.</li> </ul>	⇒ <a href="#">page 221</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li> <li>◆ The requisite cooling output is then not reached at the evaporator in the heater and air conditioning unit (the cooling output at the evaporator in the battery cooling module is OK).</li> <li>◆ High pressure increases only slightly (above the pressure measured when the engine is stationary) or equates to the specification.</li> <li>◆ Low pressure drops (possibly quickly) to the specification or lower.</li> </ul>	⇒ <a href="#">page 222</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li> <li>◆ The high pressure increases beyond the specified value</li> <li>◆ Low pressure drops quickly to the specification or lower.</li> </ul>	⇒ <a href="#">page 223</a>
<ul style="list-style-type: none"> <li>◆ The requisite cooling output is then not reached at the evaporator for battery cooling (the cooling output at the evaporator in the heater and air conditioning unit is OK).</li> <li>◆ High pressure equates to the specification or increases only slightly (above the pressure measured when the engine is stationary).</li> <li>◆ Low pressure drops to the specification or lower.</li> </ul>	⇒ <a href="#">page 226</a>





Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"> <li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li> <li>◆ High pressure does not increase or only marginally above the pressure with the engine stationary</li> <li>◆ The low pressure does not drop or only marginally</li> </ul>	⇒ <a href="#">page 227</a>

Possible deviation from specification during pressure test
<ul style="list-style-type: none"> <li>◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.</li> <li>◆ High pressure remains constant or increases only slightly (above the pressure measured when the air conditioner compressor is stationary).</li> <li>◆ High pressure drops quickly to the specification or lower.</li> </ul>
Possible causes for deviation from specification and rectification
<ul style="list-style-type: none"> <li>◆ There is too little refrigerant in the refrigerant circuit. <ul style="list-style-type: none"> <li>– Extract refrigerant from the refrigerant circuit ⇒ <a href="#">“2.4 Emptying refrigerant circuit”, page 131</a>.</li> <li>– If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ <a href="#">“1.4 Investigating leaks”, page 67</a></li> <li>– The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves. If no fault is found, renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)</li> </ul> </li> <li>◆ Actuation of air conditioner compressor (and if fitted refrigerant shut-off valve 1 and refrigerant shut-off valve 2 ) faulty ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation, ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual), ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations air conditioning system (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).</li> <li>– Check actuation and the function of the air conditioner compressor (and if fitted the shut-off valves, e.g. refrigerant shut-off valve 1 , refrigerant shut-off valve 2 ) and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation. If this is OK, extract the refrigerant from the refrigerant circuit ⇒ <a href="#">“2.4 Emptying refrigerant circuit”, page 131</a>.</li> <li>◆ The expansion valve for the evaporator in the heater and air conditioning unit is defective and must be renewed ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).</li> <li>◆ One of the refrigerant shut-off valves (if fitted) is defective (closed). Check the function and renew if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit; System overview - refrigerant circuit</li> <li>◆ Bottle-neck or blockage in refrigerant circuit (e.g. in refrigerant line between service connection on “low pressure side” and air conditioner compressor) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). <ul style="list-style-type: none"> <li>– If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ <a href="#">“1.6 Cleaning refrigerant circuit”, page 91</a>.</li> <li>– If a hose or pipe is kinked or crushed, renew this component ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).</li> </ul> </li> <li>◆ The expansion valve for the evaporator in the heater and air conditioning unit is defective and must be renewed ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).</li> <li>◆ A refrigerant shut-off valve is defective (closed). Check the function and renew ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).</li> </ul>



#### Possible deviation from specification during pressure test

##### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



## Note

- ◆ If, with this problem, no fault is found during diagnosis, check the refrigerant circuit for a bottle-neck or blockage (a bottle-neck or blockage in the refrigerant circuit can also lead to one of these complaints). If nothing is found here either, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#).
- ◆ Check the measured values of the evaporator output temperature sender - G263- and, if fitted, temperature sensor before evaporator for hybrid battery and temperature sensor after evaporator for hybrid battery as well as actuation of air conditioner compressor via the respective control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- ◆ If there is a fault in the measured value of -G263-, temperature sensor before evaporator for hybrid battery or temperature sensor after evaporator for hybrid battery (depending on the vehicle ⇒ Vehicle diagnostic tester in "Guided Fault Finding" - air conditioning system and battery regulation), problems may also be encountered in the cooling output or the evaporator could ice up.
- ◆ In the event of a fault in a temperature sensor, the evaporator may ice up even though the correct quantity of refrigerant is present in the refrigerant circuit.
- ◆ If, after repeating the test when the expansion valve has been renewed, the air conditioning system is not operating correctly, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#). Then renew the air conditioner compressor and desiccant cartridge (or reservoir/receiver) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ If the expansion valve on the evaporator in the heater and air conditioning unit or the shut-off valve is defective (always closed or does not open sufficiently), the air conditioner compressor is actuated at the maximum output and low pressure drops to the specification or lower (the air conditioner compressor draws in refrigerant from the low pressure side). Since no refrigerant can flow through the expansion valve, however, the cooling output is not reached and the high pressure may also not increase or only increase slightly owing to there being no energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The evaporator in the heater and air conditioning unit has a considerably higher output than the evaporator for battery cooling. Depending on the way the drive battery - A2- is cooled (depending on the vehicle ⇒ Vehicle diagnostic tester in "Guided Fault Finding" - air conditioning system and battery regulation), the refrigerant shut-off valve 2 on the expansion valve in the battery cooling module is currently only actuated from a certain battery temperature by the respective control unit (e.g. by battery regulation control unit) so that the power consumed by the evaporator for battery cooling is not or barely increased ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation as well as ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).



### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator in the heating and air conditioning unit (and in the evaporator for battery cooling) is reached initially. However, after a while or after an extended period of operation, the cooling output is no longer adequate.
- ◆ The high pressure and the low pressure are normal to start with
- ◆ After some time, the high pressure rises above the specification, the low pressure still equates to the specification or it drops below the specification.

### Possible causes for deviation from specification and rectification

- ◆ Radiator, condenser contaminated or actuation of the radiator is not OK
  - Check actuation of the radiator fan and repair if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system.
  - Check condenser for contamination and clean if necessary ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Engine, mechanicals; Rep. gr. 19 ; Radiator/ radiator fan .
- ◆ Actuation or the function of the air conditioner compressor (or, if fitted, the refrigerant shut-off valve 1 or refrigerant shut-off valve 2 ) is faulty.
- ◆ Moisture in refrigerant circuit
  - Check the actuation of the air conditioner compressor (and if fitted the refrigerant shut-off valve 1 and refrigerant shut-off valve 2 ) and check the measured value of the evaporator output temperature sender - G263- ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.
  - If actuation of the air conditioner compressor (and, if fitted, the refrigerant shut-off valve 1 and refrigerant shut-off valve 2 ) as well as the measured value of -G263- are OK, extract the refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
- ◆ Too much refrigerant in the refrigerant circuit
- ◆ Expansion valve defective
- ◆ If a shut-off valve is installed in the refrigerant circuit and it does not open correctly or at all ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Moisture in refrigerant circuit
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably greater (more than 100 g) than the prescribed fill volume ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there was too much refrigerant in the refrigerant circuit Recharge refrigerant circuit and repeat test.
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally higher than the prescribed fill volume (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual); there is too much refrigerant oil in the refrigerant circuit Clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) , recharge with the correct volume of refrigerant and refrigerant oil and repeat the test.
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



## Note

- ◆ If there is too much refrigerant oil in the circuit, empty the air conditioner compressor, and renew the reservoir/receiver (or desiccant cartridge) ⇒ Heating, air conditioning system; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual). After cleaning the refrigerant circuit (flushing with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#), pour in the correct amount of refrigerant oil in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00; Technical data (vehicle-specific workshop manual).
- ◆ Check the measured values of the evaporator output temperature sender - G263- and actuation of the air conditioner compressor. If the measured value of -G263- or actuation of the air conditioner compressor is faulty, the evaporator could ice up or the cooling output will not be reached ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation as well as ⇒ Heating, air conditioning; Rep. gr. 87; Overview of fitting locations - air conditioning system ⇒ Heating, air conditioning; Rep. gr. 87; Air conditioner compressor (vehicle-specific workshop manual).
- ◆ In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.
- ◆ A fault in -G263- or / and, if fitted, in the refrigerant shut-off valve for hybrid battery can also cause the refrigerant circuit to ice up. With this complaint, also take note of the measured value of -G263- and the temperature sensor after evaporator for hybrid battery (on vehicles with a battery cooling module) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ The high pressure equates to the specification
- ◆ The low pressure is too low (lower than the specification)

Possible causes for deviation from specification and rectification





### Possible deviation from specification during pressure test

- ◆ There is too little refrigerant in the refrigerant circuit.
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ [“1.4 Investigating leaks”, page 67](#)
  - The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves. If no fault is found, renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- ◆ Actuation or the function of the air conditioner compressor or, if fitted, the refrigerant shut-off valve 1 / refrigerant shut-off valve 2 is faulty.
  - Check actuation and the function of the air conditioner compressor and, if fitted, the refrigerant shut-off valve 1 / refrigerant shut-off valve 2 ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation.
  - Clean refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
- ◆ The expansion valve in the heater and air conditioning unit or, if fitted, in the evaporator for battery cooling is defective.
  - Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/reservoir).
- ◆ Air conditioner compressor is defective
  - Renew air conditioner compressor ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
  - If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or receiver/reservoir) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)





## Note

- ◆ In the event of the following fault "High pressure normal, low pressure too low", please note the following: With this fault, there is a chance that the evaporator could ice up even though the refrigerant volume in the circuit is OK.
- ◆ If the fault exists in the air conditioner compressor (it is not actuated but still works), it is not necessary to clean (flush with R1234yf refrigerant) the refrigerant circuit  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) . With this fault, it is sufficient to renew the air conditioner compressor (take note of refrigerant oil in air conditioner compressor)  
⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Technical data (vehicle-specific workshop manual).
- ◆ If the problem is with the air conditioner compressor (the air conditioner compressor is actuated at excessively high speed by the control unit for air conditioning compressor ), the refrigerant circuit does not have to be cleaned (by flushing with R1234yf refrigerant  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ). With this fault, it is sufficient to renew the air conditioner compressor (take note of refrigerant oil in air conditioner compressor) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
- ◆ If the expansion valve (or one of the two expansion valves) is defective (always closed or does not open sufficiently), the air conditioner compressor is also actuated at the maximum output and pressure drops on the low pressure side to the specification or lower (the air conditioner compressor draws in refrigerant from the low pressure side). However, since no refrigerant can flow through the defective expansion valve, the required cooling output in the downstream evaporator is not reached, the high pressure may also not rise or only marginally since no energy exchange is taking place. The air conditioner compressor can be actuated at a higher speed, however, since the requisite cooling output in one evaporator is not reached. The same also applies if operation or actuation of the refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Check the measured values of the evaporator output temperature sender - G263- (and, if fitted, the measured values of the temperature sensor before evaporator for hybrid battery and temperature sensor after evaporator for hybrid battery ) as well as actuation of the air conditioner compressor by the control unit for air conditioning compressor . If the measured value of -G263- (of the temperature sensor before evaporator for hybrid battery , the temperature sensor after evaporator for hybrid battery - G757- ) or actuation of the air conditioner compressor are faulty, the evaporator can ice up or the requisite cooling output will not be reached ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioner compressor and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual).



### Possible deviation from specification during pressure test

- ◆ The air conditioner compressor is noisy (especially immediately after being switched on),
- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit and / or in the evaporator for battery cooling is not reached.
- ◆ High pressure normal or too high
- ◆ Low pressure too high (specification is not reached)

### Possible causes for deviation from specification and rectification

- ◆ Actuation or the function of the air conditioner compressor or, if fitted, the refrigerant shut-off valve 1 / refrigerant shut-off valve 2 is faulty.
- ◆ Too much refrigerant or refrigerant oil in the refrigerant circuit.
  - Check the actuation and function of the air conditioner compressor and, if fitted, the refrigerant shut-off valve 1 / refrigerant shut-off valve 2 ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation. Repair if necessary. If no fault can be found, extract the refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#).
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#).
  - If the extracted refrigerant volume is considerably greater (more than 100 g) than the prescribed fill volume ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there was too much refrigerant in the refrigerant circuit Recharge refrigerant circuit and repeat test.
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally higher than the prescribed fill volume (less than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), there is too much refrigerant oil in the refrigerant circuit Clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#), recharge with the correct volume of refrigerant and refrigerant oil and repeat the test.
- ◆ Expansion valve defective
  - Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/reservoir) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Air conditioner compressor is defective
  - Renew air conditioner compressor ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).
  - If dirt is found in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant) and renew the expansion valve and desiccant bag/desiccant cartridge (or receiver/reservoir) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



## Note

- ◆ The cause for this fault could also be too much refrigerant oil in the refrigerant circuit. Overfilling with refrigerant oil can occur if e.g. the refrigerant oil level was not checked after the air conditioner compressor was renewed

⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual). If there is too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant)

⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .

- ◆ If the expansion valve on the evaporator in the heater and air conditioning unit (or for the evaporator for battery cooling) is defective (always closed or does not open sufficiently), the air conditioner compressor is actuated at the maximum output and low pressure drops to the specification or lower (the air conditioner compressor draws in refrigerant from the low pressure side). However, since no refrigerant can flow through the expansion valve, the required cooling output is not reached, the high pressure may also not rise or only marginally since no energy exchange is taking place. The same also applies if operation or actuation of the refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ High pressure and low pressure normal (equates to specification)

### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ Actuation or the function of the air conditioner compressor and, if fitted, the refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty.
- ◆ Insufficient refrigerant in refrigerant circuit.
  - Check the actuation and function of the air conditioner compressor and/or, if fitted, the refrigerant shut-off valve 1 / refrigerant shut-off valve 2 ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation. Repair if necessary ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). If no fault can be found, extract the refrigerant from the refrigerant circuit.
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ [“1.4 Investigating leaks”, page 67](#)
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), the expansion valve for the evaporator or an installed shut-off valve in the heater and air conditioning unit is defective.
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One of the refrigerant shut-off valves (if fitted) is defective (closed). Check the function and renew if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Too much refrigerant oil in the refrigerant circuit.
  - Clean refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
  - Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



## Note

- ◆ *The cause for this fault could also be too much refrigerant oil in the refrigerant circuit. Overfilling with refrigerant oil can occur if e.g. the refrigerant oil level was not checked after the air conditioner compressor was renewed  
⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual). If there is too much refrigerant oil in the refrigerant circuit, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit (or for the evaporator for battery cooling) is defective (always closed or does not open sufficiently), the air conditioner compressor is actuated at the maximum output and low pressure drops to the specification or lower (the air conditioner compressor draws in refrigerant from the low pressure side). However, since no refrigerant can flow through the expansion valve, the required cooling output is not reached, the high pressure may also not rise or only marginally since no energy exchange is taking place. The same also applies if operation or actuation of the refrigerant shut-off valve 1 or refrigerant shut-off valve 2 is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ The high pressure equates to the specification
- ◆ The low pressure equates to the specification or is too low

### Possible causes for deviation from specification and rectification





### Possible deviation from specification during pressure test

- ◆ Actuation of the air conditioner compressor (and/or if fitted the refrigerant shut-off valve 1 , refrigerant shut-off valve 2 ) is faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- Check the actuation and function of the air conditioner compressor (and if fitted the refrigerant shut-off valve 1 , refrigerant shut-off valve 2 ) and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation. If this is OK, extract the refrigerant from the refrigerant circuit.
- ◆ There is too little refrigerant in the refrigerant circuit.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data . Check the function of the refrigerant shut-off valves ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ A refrigerant shut-off valve is defective (closed). Check the function and renew ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Too much refrigerant oil in the refrigerant circuit.
- Clean refrigerant circuit (flush with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) .
- Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



### Note

Observe the information relating to this ⇒ [page 212](#) and  
⇒ [page 220](#) .

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ The high pressure equates to the specification
- ◆ Low pressure drops quickly to the specification or lower.

### Possible causes for deviation from specification and rectification





### Possible deviation from specification during pressure test

- ◆ Actuation or function of air conditioner compressor defective.
- ◆ Constriction or obstruction in refrigerant circuit
  - Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation. If no fault can be found, touch the refrigerant circuit by hand to feel for a temperature drop ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If a temperature drop is determined in a component. If a hose or pipe is kinked or crushed, renew this component ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
- ◆ There is too little refrigerant in the refrigerant circuit.
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ [“1.4 Investigating leaks”, page 67](#) .
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), check the function of the expansion valve and shut-off valves ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ A refrigerant shut-off valve is defective (closed). Check the function and renew ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



### Note

Observe the information relating to this ⇒ [page 212](#) and  
⇒ [page 220](#) .

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ The requisite cooling output is then not reached at the evaporator in the heater and air conditioning unit (the cooling output at the evaporator in the battery cooling module is OK).
- ◆ High pressure increases only slightly (above the pressure measured when the air conditioner compressor is stationary) or equates to the specification.
- ◆ Low pressure drops (possibly quickly) to the specification or lower.

### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ There is too little refrigerant in the refrigerant circuit.
  - Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
  - If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ [“1.4 Investigating leaks”, page 67](#)
  - If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), check the function of the expansion valve and shut-off valves ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The expansion valve for the evaporator in the heater and air conditioning unit is defective ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One of the refrigerant shut-off valves is defective (closed). Check the function and renew if necessary ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If fitted, check the function of the installed shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Bottle-neck or blockage in refrigerant circuit (e.g. in refrigerant line between service connection on “low pressure side” and air conditioner compressor) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Actuation of the air conditioner compressor is faulty ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation.
  - Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation. If no fault can be found, touch the refrigerant circuit by hand to feel for a temperature drop ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If a temperature drop is determined in a component. If a hose or pipe is kinked or crushed, renew this component (the defective expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual). If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
  - If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) . Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



### Note

Observe the information relating to this ⇒ [page 212](#) .

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ The high pressure increases beyond the specified value
- ◆ Low pressure drops quickly to the specification or lower.



## Possible deviation from specification during pressure test

### Possible causes for deviation from specification and rectification

- ◆ Actuation or function of air conditioner compressor defective.
- ◆ Constriction or obstruction in refrigerant circuit
- ◆ Expansion valve defective
- Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode - air conditioning system and battery regulation. If no fault can be found, touch the refrigerant circuit by hand to feel for a temperature drop ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If a temperature drop is determined in a component. If a hose or pipe is kinked or crushed, renew this component (the defective expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) . Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ [“1.5 Renewing components”, page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ There is too little refrigerant in the refrigerant circuit.
- Extract refrigerant from the refrigerant circuit ⇒ [“2.4 Emptying refrigerant circuit”, page 131](#) .
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ [“1.4 Investigating leaks”, page 67](#)
- If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), check the function of the refrigerant shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)





## Note

- ◆ *If the function of the air conditioning system is not OK when the test is repeated, renew the expansion valve and desiccant bag/desiccant cartridge (or reservoir/receiver) and, if fitted, the refrigerant shut-off valve ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit or the refrigerant shut-off valve 1 is defective (always closed or does not open sufficiently), the air conditioner compressor is actuated at the maximum output and low pressure drops to the specification or lower (the air conditioner compressor draws in refrigerant from the low pressure side). Since no refrigerant can flow through the expansion valve (the refrigerant shut-off valve ), however, the cooling output is not reached and the high pressure may also not increase or only increase slightly owing to there being no energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *If the expansion valve on the evaporator for battery cooling is defective (or the function or actuation of the refrigerant shut-off valve 2 is faulty), completely closed or does not open sufficiently, the air conditioner compressor is likewise actuated with the maximum output (the requisite temperatures in the battery cooling module are not reached). The pressure on the low pressure side only drops to the specification or lower if, at the same time, no cooling output is required in the heater and air conditioning unit (the refrigerant shut-off valve 1 is actuated and is closed). The air conditioner compressor extracts refrigerant on the low pressure from both evaporators. Since no refrigerant can flow through the expansion valve in the heater and air conditioning unit (the refrigerant shut-off valve 1 ), however, and the cooling output for battery cooling is not reached (there is a fault in the area of battery cooling), the electric air conditioning compressor is actuated at a higher speed. However, since no more refrigerant can flow, the pressure on the low pressure side drops below the specified value and the high pressure may also not increase or only increase slightly due to the absence of an energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning and battery control ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *Since the output of the evaporator for battery cooling is considerably lower than the output of the evaporator in the heating and air conditioning unit, the requisite specified temperature for battery cooling may still be reached if there is insufficient refrigerant in the circuit but the specified temperature in the evaporator of the heating and air conditioning unit will not be reached (even though the air conditioner compressor is actuated at a higher speed).*



- ◆ If there is too much refrigerant in the refrigerant circuit, the air conditioner compressor must be emptied and the desiccant bag (desiccant cartridge) or reservoir/receiver renewed. After cleaning (flushing with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) the refrigerant circuit, pour the correct volume of refrigerant oil in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data; Approved refrigerant oils and refrigerant oil fill volumes (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Observe the additional information relating to this  
⇒ [page 212](#).

#### Possible deviation from specification during pressure test

- ◆ The requisite cooling output is then not reached at the evaporator for battery cooling (the cooling output at the evaporator in the heater and air conditioning unit is OK).
- ◆ High pressure equates to the specification or increases only slightly (above the pressure measured when the engine is stationary).
- ◆ Low pressure drops to the specification or lower.

#### Possible causes for deviation from specification and rectification

- ◆ Actuation or the function of the refrigerant shut-off valve 2 , a control motor, the blower or a temperature sensor in or on the battery cooling module is defective. Check and repair if necessary ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The expansion valve for the evaporator in the battery cooling module is defective.
  - Renew the expansion valve for the evaporator for battery cooling ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - Check the function and actuation of the components for battery cooling ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation. Check the refrigerant lines if no fault can be found.
- ◆ Bottle-neck or blockage in refrigerant line to or from expansion valve on evaporator for battery cooling.
  - If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) . Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If a hose or pipe is kinked or crushed, renew this component ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Too little refrigerant in circuit.
- ◆ Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
- ◆ If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- ◆ If the extracted refrigerant volume equates to the prescribed fill volume or is marginally lower (max. 100 g) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), check the refrigerant shut-off valve 1 ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

#### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)





## Note

- ◆ To cool the drive battery - A2- (hybrid battery), the refrigerant shut-off valve 1 is only actuated by e.g. the battery regulation control unit from a certain battery temperature. If, at this point, air conditioning operation has not already been activated, the electrical air conditioner compressor - V470- is actuated via the control unit for air conditioning compressor - J842- e.g. by the battery regulation control unit . The temperature of the air (or refrigerant) before and after the evaporator for battery cooling is calculated by the respective control unit (e.g. battery regulation control unit ). If it is found that cooling down is insufficient, this is stored in e.g. the battery regulation control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- ◆ The temperature of the air (or the coolant) and thereby the cooling output of the evaporator for battery cooling is determined by the integrated temperature sensor (it cannot currently be measured during operation with a thermometer) and can therefore only be checked by means of guided fault finding ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation.
- ◆ Observe the additional information relating to this ⇒ [page 212](#).

### Possible deviation from specification during pressure test

- ◆ The requisite cooling output in the evaporator of the heating and air conditioning unit (and in the evaporator for the battery cooling module) is not reached.
- ◆ High pressure does not increase or only marginally above the pressure with the engine stationary
- ◆ The low pressure does not drop or only marginally

### Possible causes for deviation from specification and rectification

- ◆ No actuation of air conditioner compressor ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ If fitted, refrigerant shut-off valve 1 defective (closed)
  - Check the actuation and function of the air conditioner compressor (and the refrigerant shut-off valve 1 , refrigerant shut-off valve 2 ) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation. If no fault can be found, renew the expansion valve on the evaporator in the heating and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Bottle-neck or blockage in refrigerant circuit (e.g. in refrigerant line between service connection on "low pressure side" and air conditioner compressor).
  - If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) . Renew the expansion valve for the evaporator in the heater and air conditioning unit (and for the evaporator for battery cooling) as well as the desiccant bag/desiccant cartridge (or reservoir/receiver) ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If a hose or pipe is kinked or crushed, renew this component ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ The air conditioner compressor is defective.
  - Renew air conditioner compressor ⇒ ["1.5 Renewing components", page 78](#) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Air conditioner compressor (vehicle-specific workshop manual).

### Final measures





#### Possible deviation from specification during pressure test

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)

#### Specifications for pressures in refrigerant circuit on vehicles with heat pump



##### Note

- ◆ *On vehicles with high-voltage system and heat pump, the refrigerant circuit is fitted with non-return valves and electrically actuated valves that regulate the flow of refrigerant in the refrigerant circuit depending on the prevailing operating status. These valves come in different versions ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.*
- ◆ *On vehicles with “heat pump” function and/or “high-voltage battery cooling” function, high pressure is not always at the service connection on the high pressure side in all operating conditions of the air conditioning system. On these vehicles, depending on the operating status of the air conditioning system, pressure in the refrigerant circuit on the high pressure side can only be measured via the pressure/temperature sender installed in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester “Guided Fault Finding” mode.*
- ◆ *The refrigerant circuit of the air conditioning system on these vehicles is used not only to cool the passenger compartment but also to cool the hybrid battery unit (via the coolant circuit for the high-voltage system) and to heat the passenger compartment (at low ambient temperatures) via the heat pump function. To ensure that these functions are effective, various valves, pressure and temperature senders as well as pumps in the refrigerant circuit and in the coolant circuit of the high-voltage system must be installed correctly and be in good working order ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual), ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Engine, mechanicals; Rep. gr. 19 ; Cooling system/coolant*
- ◆ *To localise the potential cause of the malfunction, various routines have been stored in the basic settings of the thermal management control unit with which the “air conditioning cooling”, “heat pump” and “cooling components of the high-voltage system” functions can be actuated ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode.*

#### High-pressure side:

Rising from starting pressure (when pressure gauge is connected) to maximum 20 bar.



#### Note

*Depending on the location of the service connection on the high pressure side and on the operating status, the high pressure can only be measured using pressure/temperature sensors installed in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).*

#### Low-pressure side:

From the output pressure (when connecting the pressure gauge) dropping to a value of between 1.5 and 2.3 bar absolute pressure (depending on required cooling output).

#### Speed of air conditioner compressor:

Between 800 and 8500 rpm depending on the required cooling output (currently maximum 5000 rpm with vehicle stationary).



## Note

- ◆ *The temperature of the air after the evaporator, the current air conditioner compressor speed and the pressure of the refrigerant on the high pressure side are displayed as a measured value by different control units depending on the vehicle (e.g. by the thermal management control unit, the operating and display unit for front air conditioning system or the Climatronic control unit) ⇒ Heating, air conditioning; Rep. gr. 87; Overview of fitting locations - air conditioning system (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *In the event of a very high cooling output (e.g. at high outside temperatures and high fresh air blower speed), the air conditioner compressor is initially incapable of changing the pressure on the low pressure side to the required level (e.g. for a certain period after switching on the air conditioning system). The air conditioner compressor is not activated with the max. specified (of approx. 8500 rpm), if the vehicle stands still or drives slowly (up to a vehicle speed of 45 km/h). The air conditioner compressor speed is then limited to 5000 rpm. The maximum permissible air conditioner compressor speed limit is not lifted until a vehicle speed greater than approx. 45 km/h is reached. The output (delivery rate) of the air conditioner compressor at an air conditioner compressor speed of 5000 rpm, a high ambient temperature and high fresh air blower speed (unfavourable ambient conditions) is initially no longer sufficient to bring the pressure on the low pressure side down to the specified value. To check the regulating behaviour of the air conditioner compressor under these conditions, e.g. only actuate the fresh air blower with approx. 40% of the maximum voltage and check the pressures at reduced fresh air blower speed ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation and ⇒ Heating, air conditioning; Rep. gr. 00; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *Under unfavourable conditions (very high ambient temperatures, high atmospheric humidity), the pressure on the high pressure side can increase to a maximum of 29 bar.*
- ◆ *The specified speed of the air conditioner compressor is displayed as a measured value e.g. by the thermal management control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.*
- ◆ *The pressure measured by various pressure/temperature senders in the refrigerant circuit (low or high pressure) depending on the respective operating status is displayed as a measured value by the respective control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).*
- ◆ *The low pressure adjusts itself depending on the speed of the air conditioner compressor and the regulating characteristic of the expansion valve (on the evaporator of the front heating and air conditioning unit) within the performance band of the air conditioner compressor in the tolerance range (1.5 to 2.3 overpressure).*
- ◆ *The specified speed of the air conditioner compressor must be greater than 1500 rpm for this test.*



- ◆ For the "maximum cooling output" setting, the specified speed is regulated at approx. 4000 to 5000 rpm. This value is vehicle-specific and is displayed as a measured value by the respective control unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ Absolute pressure means that 0 bar corresponds to an absolute vacuum. The normal ambient pressure corresponds to 1 bar absolute. On most pressure gauges, a reading of 0 bar corresponds to an absolute pressure of 1 bar (which can be identified by -1 bar under the 0 scale marking).
- ◆ If on a vehicle with 2 evaporators (one in the heating and air conditioning unit and one for cooling the high-voltage components, e.g. the heat exchanger for the high-voltage battery) and 2 condensers (one on the front end for the air conditioning system and one as a heat exchanger for the heat pump function), the specifications for the measured temperatures or pressures are met on one component but not on another (depending on the selected function), check actuation of the electrically actuated valves installed in the refrigerant circuit. When doing this, observe the pressure distribution in the refrigerant circuit depending on the installed non-return valves ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual)
- ◆ For the air conditioning system to function correctly, it is also important - depending on the selected function - for sufficient heat to be supplied to the respective heat exchangers and subsequently dissipated. Also note, therefore, the inclusion of the heat exchangers in the respective coolant circuit of the engine and the high-voltage system and the function of the pumps and valves installed therein ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Since the output of the evaporator for cooling on the high-voltage components (in the battery cooling module and in the heat exchanger for high-voltage battery) is lower than the output of the evaporator in the heating and air conditioning unit, the requisite specified temperature in the evaporator for cooling of the high-voltage components may still be reached if there is insufficient refrigerant in the circuit but the specified temperature in the evaporator of the heating and air conditioning unit is no longer reached (even though the air conditioner compressor is actuated at a higher speed).

Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"> <li>• High pressure remains constant or increases only slightly (above the pressure measured when the engine is stopped).</li> <li>• High pressure drops quickly to the specification or lower.</li> <li>• The requisite cooling output in the evaporator of the heating and air conditioning unit and in the evaporator for cooling the high-voltage components is not reached.</li> </ul>	⇒ <a href="#">page 233</a>
<ul style="list-style-type: none"> <li>• High pressure normal</li> <li>• Low pressure equates to specification</li> <li>• The required cooling output is not reached.</li> </ul>	⇒ <a href="#">page 236</a>



Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"><li>• High pressure normal</li><li>• Low pressure normal or too low (lower than specification)</li><li>• The requisite cooling output is then not reached at the evaporator in the heater and air conditioning unit (the cooling output at the evaporator to cool the high-voltage components is OK).</li></ul>	<a href="#">⇒ page 237</a>
<ul style="list-style-type: none"><li>• High pressure normal</li><li>• Low pressure normal or too low (lower than specification)</li><li>• The requisite cooling output is then not reached at the evaporator to cool the high-voltage components (the cooling output at the evaporator in the heating and air conditioning unit is OK).</li></ul>	<a href="#">⇒ page 238</a>
<ul style="list-style-type: none"><li>• High pressure does not increase or only marginally above the pressure with the engine stationary.</li><li>• The low pressure does not drop or only marginally.</li><li>• The requisite cooling output in the evaporator of the heating and air conditioning unit and in the evaporator for cooling the high-voltage components is not reached.</li></ul>	<a href="#">⇒ page 239</a>
<ul style="list-style-type: none"><li>• High pressure increases above specification</li><li>• Low pressure drops quickly to the specification</li><li>• The requisite cooling output in the evaporator of the front heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.</li></ul>	<a href="#">⇒ page 240</a>
<ul style="list-style-type: none"><li>• The high pressure and low pressure are normal to start with but after a while the high pressure rises above the specification and the low pressure drops to the specification or lower.</li><li>• The requisite cooling output in the evaporator of the heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached or no longer reached.</li></ul>	<a href="#">⇒ page 242</a>
<ul style="list-style-type: none"><li>• High pressure and low pressure are normal at first but after a longer drive the low pressure falls to below the specification (evaporator in heater and air conditioning unit iced up).</li></ul>	<a href="#">⇒ page 243</a>



Possible deviations from specification, cause and rectification	
<ul style="list-style-type: none"> <li>High pressure normal</li> <li>Low pressure too low</li> <li>The requisite cooling output in the evaporator of the heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.</li> </ul>	⇒ page 245
<ul style="list-style-type: none"> <li>High pressure normal or too high</li> <li>Low pressure too high</li> <li>The air conditioner compressor is noisy (especially immediately after being switched on)</li> <li>The requisite cooling output in the evaporator of the front heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.</li> </ul>	⇒ page 246
<ul style="list-style-type: none"> <li>High pressure and low pressure normal</li> <li>The requisite cooling output in the evaporator of the heating and air conditioning unit and in the evaporator for cooling the high-voltage components is not reached.</li> </ul> <p>or</p> <ul style="list-style-type: none"> <li>High pressure and low pressure normal</li> <li>The air conditioner compressor is noisy (especially immediately after being switched on)</li> <li>The requisite cooling output in the evaporator of the heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.</li> </ul>	⇒ page 248
<ul style="list-style-type: none"> <li>High pressure and low pressure normal</li> <li>The requisite cooling output in the evaporator of the front heating and air conditioning unit (and in the evaporator for cooling the high-voltage components) is not reached.</li> <li>The requisite cooling output is not reached in the heat exchanger for heat pump operation.</li> </ul>	⇒ page 249

Possible deviation from specification during pressure test
<ul style="list-style-type: none"> <li>High pressure remains constant or increases only slightly (above the pressure measured when the engine is stopped).</li> <li>High pressure drops quickly to the specification or lower.</li> <li>The requisite cooling output in the evaporator of the heating and air conditioning unit and in the evaporator for cooling the high-voltage components is not reached.</li> </ul>
Possible causes for deviation from specification and rectification





#### Possible deviation from specification during pressure test

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Too little refrigerant in circuit.
- ◆ Actuation of the air conditioner compressor or one of the valves installed in the refrigerant circuit faulty.
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system . If no fault can be found, extract the refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves. If no fault is found, renew the expansion valve for the evaporator in the heater and air conditioning unit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- Depending on the result, repair the actuation or renew the defective component (air conditioner compressor, shut-off valve, expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

#### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



## Note

- ◆ To localise the potential cause of the malfunction, various routines have been stored in the basic settings of the respective control unit (e.g. in the thermal management control unit) with which the "air conditioning cooling", "heat pump" and "cooling components of the high-voltage system" functions can be actuated ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ If no fault is found with this complaint, first check actuation of the electrically actuated valves installed in the refrigerant circuit. If no fault can be found here, remove and check the non-return valves installed in the refrigerant circuit. If no fault can be found here either, clean the refrigerant circuit (flush with R1234yf refrigerant). A bottle-neck or a blockage in the refrigerant circuit can also result in one of these complaints ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#)
- ◆ On vehicles with "heat pump" function and/or "high-voltage battery cooling" function, high pressure is not always at the service connection on the high pressure side in all operating conditions of the air conditioning system. On these vehicles, depending on the operating status of the air conditioning system, pressure in the refrigerant circuit on the high-pressure side can only be measured via the pressure/temperature sender installed in the refrigerant circuit ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Vehicle diagnostic tester "Guided Fault Finding" mode.
- ◆ Before commencing the repair work, check the measured values of the various pressure/temperature senders installed in the refrigerant circuit. If there is a fault in the measured value of a pressure/temperature sender, problems in the cooling output may also be experienced or the evaporator in the front heating and air conditioning unit could ice up ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual), ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Current flow diagrams, Electrical fault finding and Fitting locations.
- ◆ When checking the various functions (heat pump or cooling of the high-voltage battery) take note also of the actuation and function of the components of the coolant circuit that are related to these functions ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit (vehicle-specific workshop manual).
- ◆ If, after repeating the test when the expansion valve has been renewed, the air conditioning system is not operating correctly, clean the refrigerant circuit (flush with R134a refrigerant) ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) . Then renew air conditioner compressor and receiver/desiccant cartridge.
- ◆ In the event of a fault in a temperature sensor, the evaporator may ice up even though the correct quantity of refrigerant is present in the circuit.



- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit is defective (always closed or does not open sufficiently), the air conditioner compressor is actuated at the maximum output and low pressure drops to the diagram value or lower (the air conditioner compressor draws in refrigerant from the low pressure side). Since refrigerant cannot flow via the expansion valve, however, the cooling output is not reached and the high pressure may also not increase or only increase slightly due to the absence of energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair information; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *The evaporator in the heater and air conditioning unit has a higher output than the evaporator in the battery cooling module. The expansion valve in front of this evaporator (the heat exchanger for cooling the components of the high-voltage system) is currently actuated, depending on the version, only from or up to a certain battery temperature to cool the drive battery / hybrid battery unit (hybrid battery) by the respective control unit so that the energy exchange through this evaporator is not increased or only marginally ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair instructions; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *If there is too much refrigerant in the refrigerant circuit, the air conditioner compressor must also be emptied (flushed) and the receiver/desiccant cartridge renewed. After cleaning the refrigerant circuit (flushing with R134a refrigerant) ⇒ "1.6 Cleaning refrigerant circuit", page 91 , pour in the correct amount of refrigerant oil in the circuit (in the air conditioner compressor) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).*

<b>Possible deviation from specification during pressure test</b>
<ul style="list-style-type: none"><li>• High pressure normal</li><li>• Low pressure equates to specification</li><li>• The required cooling output is not reached.</li></ul>
<b>Possible causes for deviation from specification and rectification</b>



#### Possible deviation from specification during pressure test

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Too little refrigerant in circuit.
- ◆ Shut-off valve before the expansion valve for the evaporator in the front heating and air conditioning unit defective.
- ◆ One of the other valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Expansion valve for the evaporator in the front heating and air conditioning unit defective.
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system . If no fault can be found, extract the refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#)
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Depending on the result, repair the actuation or renew the defective component (shut-off valve/expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

#### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



#### Note

Observe the information relating to this ⇒ [page 235](#) .

#### Possible deviation from specification during pressure test

- High pressure normal
- Low pressure normal or too low (lower than specification)
- The requisite cooling output is then not reached at the evaporator in the heater and air conditioning unit (the cooling output at the evaporator to cool the high-voltage components is OK).

#### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Too little refrigerant in circuit.
- ◆ Actuation of air conditioner compressor is defective.
- ◆ Expansion valve for the evaporator in the front heating and air conditioning unit defective.
- ◆ Shut-off valve before the expansion valve for the evaporator in the front heating and air conditioning unit defective.
- ◆ One of the other valves installed in the refrigerant circuit is defective or does not work properly.
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system . If no fault can be found, extract the refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Depending on the result, repair the actuation or renew the defective component (shut-off valve/expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



### Note

Observe the information relating to this ⇒ [page 235](#) .

### Possible deviation from specification during pressure test

- High pressure normal
- Low pressure normal or too low (lower than specification)
- The requisite cooling output is then not reached at the evaporator to cool the high-voltage components (the cooling output at the evaporator in the heating and air conditioning unit is OK).

### Possible causes for deviation from specification and rectification





#### Possible deviation from specification during pressure test

- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One of the pumps or one of the valves in the coolant circuit of the high-voltage battery is defective or does not work properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit (vehicle-specific workshop manual).
- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Bottle-neck or blockage in the refrigerant line to or from the expansion valve on the evaporator used to cool the high-voltage components
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check the function and actuation of the components used to cool the high-voltage components ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system, air conditioner compressor and battery regulation
- Depending on the result, repair the actuation or renew the defective component (shut-off valve, expansion valve, coolant pump, coolant shut-off valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual) and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check the lines of the refrigerant circuit. If a hose or pipe is kinked or crushed, renew this component.
- If no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ).

#### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



#### Note

Observe the information relating to this ⇒ [page 235](#) .

#### Possible deviation from specification during pressure test

- High pressure does not increase or only marginally above the pressure with the engine stationary.
- The low pressure does not drop or only marginally.
- The requisite cooling output in the evaporator of the heating and air conditioning unit and in the evaporator for cooling the high-voltage components is not reached.

#### Possible causes for deviation from specification and rectification





#### Possible deviation from specification during pressure test

- ◆ No actuation of the air conditioner compressor. The air conditioner compressor is not driven.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Bottle-neck or blockage in refrigerant circuit (e.g. in refrigerant line between service connection on “low pressure side” and air conditioner compressor).
- Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Depending on the result, repair the actuation or renew the defective component (air conditioner compressor, shut-off valve, expansion valve) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check the lines of the refrigerant circuit. If a hose or pipe is kinked or crushed, renew this component ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Touch the refrigerant circuit by hand during operation to feel for temperature drops (bottle-neck or blockage). If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .
- If no fault can be found in the air conditioner compressor, renew the air conditioner compressor  
⇒ [“1.5 Renewing components”, page 78](#)
- If no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) ).

#### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



#### Note

Observe the information relating to this ⇒ [page 235](#) .

#### Possible deviation from specification during pressure test

- High pressure increases above specification
- Low pressure drops quickly to the specification
- The requisite cooling output in the evaporator of the front heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.

#### Possible causes for deviation from specification and rectification



#### Possible deviation from specification during pressure test

- ◆ Actuation or function of air conditioner compressor defective.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Constriction or obstruction in refrigerant circuit
- ◆ Expansion valve defective
- Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in “Guided Fault Finding” mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check the lines of the refrigerant circuit. If a hose or pipe is kinked or crushed, renew this component ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Touch the refrigerant circuit by hand during operation to feel for temperature drops (bottle-neck or blockage). If there is a blockage, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) .

#### Final measures

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



## Note

- ◆ *In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.*
- ◆ *If the expansion valve on the evaporator in the heater and air conditioning unit or the previously installed shut-off valve is defective (always closed or does not open sufficiently), the air conditioner compressor is actuated at the maximum output and low pressure drops to the specification or lower (the air conditioner compressor draws in refrigerant from the low pressure side). Since no (or too little) refrigerant can flow via the expansion valve, however, the cooling output is not reached and the high pressure may also not increase or only increase slightly due to the absence of energy exchange ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system and battery regulation ⇒ Heating, air conditioning; Rep. gr. 00; Repair information; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *If the expansion valve in front of the evaporator used to cool the high-voltage components is defective (or function and actuation are faulty), permanently closed or does not open far enough, the air conditioner compressor is likewise actuated with maximum output (the requisite temperatures in the heat exchanger are not reached). The pressure on the low pressure side then only drops to the specification or lower if, at the same time, no cooling output is required in the heating and air conditioning unit. The air conditioner compressor extracts refrigerant on the low pressure from both evaporators. Since no refrigerant can flow through the expansion valve in the front heating and air conditioning unit, however, and the cooling output in the evaporator used to cool the high-voltage components is not reached (there is a fault in the area of the evaporator used to cool the high-voltage components), the electrical air conditioning compressor is actuated with a higher speed. However, no refrigerant can flow, which causes pressure on the low pressure side to drop below the specification. High pressure may not rise or only marginally as no energy exchange takes place. The same applies if a valve in the refrigerant circuit is not OK, if there is a fault with integration of the evaporator for cooling of the high-voltage components in the refrigerant circuit of the high-voltage system or a pump or valve installed there is not OK. Here, the heat exchanger for high-voltage battery does actually cool down but the cooled coolant does not reach the high-voltage components that need to be cooled down ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning system; Rep. gr. 87; Coolant circuit (vehicle-specific workshop manual).*
- ◆ *Further notes regarding this ⇒ [page 235](#).*

### Possible deviation from specification during pressure test

- The high pressure and low pressure are normal to start with but after a while the high pressure rises above the specification and the low pressure drops to the specification or lower.
- The requisite cooling output in the evaporator of the heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached or no longer reached.

### Possible causes for deviation from specification and rectification



#### Possible deviation from specification during pressure test

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Actuation and function of air conditioner compressor faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Moisture in refrigerant circuit
  - Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
  - Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode
  - Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ).

#### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



#### Note

Observe the information relating to this ⇒ [page 235](#) .

#### Possible deviation from specification during pressure test

- High pressure and low pressure are normal at first but after a longer drive the low pressure falls to below the specification (evaporator in heater and air conditioning unit iced up).

#### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Actuation and function of air conditioner compressor faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Moisture in refrigerant circuit
  - Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
  - Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode
  - Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
  - If no fault can be found, renew the desiccant bag/desiccant cartridge (or reservoir/receiver) and evacuate the refrigerant circuit for at least 3 hours.

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



### Note

- ◆ *With this complaint, there is no need to clean the refrigerant circuit (flush with R1334yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ) as there is usually only a small amount of moisture in the system, which can be removed by a longer evacuation period.*
- ◆ *If this complaint occurs after a longer period of operation or only occasionally due to moisture in the refrigerant circuit (low pressure falls below the specification and the evaporator ices up), renewing the dryer (fitted within the receiver) is sufficient. Refrigerant circuit is then to be evacuated for at least 3 hours.*
- ◆ *In this case, the evaporator may ice up even though the correct volume of refrigerant is present in the refrigerant circuit.*
- ◆ *A fault in the evaporator output temperature sender - G263- and / or a pressure/temperature sender could also cause the refrigerant circuit to ice up. With this complaint, therefore, also take note of the measured values of the various pressure/temperature senders in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 00 ; Repair information; Checking cooling output (vehicle-specific workshop manual).*
- ◆ *Further notes regarding this ⇒ [page 235](#) .*





### Possible deviation from specification during pressure test

- High pressure normal
- Low pressure too low
- The requisite cooling output in the evaporator of the heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.

### Possible causes for deviation from specification and rectification

- ◆ Too little refrigerant in circuit.
- ◆ Actuation or function of the air conditioner compressor defective ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system . If no fault can be found, extract the refrigerant.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)
- Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode
- Check the function and actuation of the various valves installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Depending on the result, repair the actuation or renew the defective component (air conditioner compressor, shut-off valve, expansion valve, pressure/temperature sender) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If no fault can be found, clean the refrigerant circuit (flush with R1234yf refrigerant)  
⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) )

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)





## Note

- ◆ In the event of the following fault "High pressure normal, low pressure too low", please note the following: With this fault, there is a chance that the evaporator in the heating and air conditioning unit could ice up even though the refrigerant volume in the circuit is OK.
- ◆ If the problem is with the air conditioner compressor (the air conditioner compressor is actuated at excessively high speed by the control unit for air conditioning compressor), the refrigerant circuit does not have to be cleaned (by flushing with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#)). With this fault, it is sufficient to renew the air conditioner compressor (take note of refrigerant oil in air conditioner compressor and replenish as necessary).
- ◆ If the expansion valve in front of the evaporator used to cool the high-voltage components is defective (or function and actuation are faulty), permanently closed or does not open far enough, the air conditioner compressor is likewise actuated with maximum output (the requisite temperatures in the heat exchanger are not reached). The pressure on the low pressure side then only drops to the specification or lower if, at the same time, no cooling output is required in the heating and air conditioning unit. The air conditioner compressor extracts refrigerant on the low pressure from both evaporators. Since no refrigerant can flow through the expansion valve in the front heating and air conditioning unit, however, and the cooling output in the evaporator used to cool the high-voltage components is not reached (there is a fault in the area of the evaporator used to cool the high-voltage components), the electrical air conditioning compressor is actuated with a higher speed. However, no refrigerant can flow, which causes pressure on the low pressure side to drop below the specification. High pressure may not rise or only marginally as no energy exchange takes place. The same applies if a valve in the refrigerant circuit is not OK, if there is a fault with integration of the evaporator for cooling of the high-voltage components in the refrigerant circuit of the high-voltage system or a pump or valve installed there is not OK. Here, the heat exchanger for high-voltage battery does actually cool down but the cooled coolant does not reach the high-voltage components that need to be cooled down ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning system; Rep. gr. 87; Coolant circuit (vehicle-specific workshop manual).
- ◆ A fault in the evaporator output temperature sender G263- and / or a pressure/temperature sender could also cause this problem. Therefore, also take note of the measured values of the various pressure/temperature senders in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 00; Repair information; Checking cooling output (vehicle-specific workshop manual).
- ◆ Further notes regarding this ⇒ [page 235](#).



### Possible deviation from specification during pressure test

- High pressure normal or too high
- Low pressure too high
- The air conditioner compressor is noisy (especially immediately after being switched on)
- The requisite cooling output in the evaporator of the front heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.

### Possible causes for deviation from specification and rectification

- ◆ Actuation and function of air conditioner compressor faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Too much refrigerant in circuit.
- ◆ Too much refrigerant oil in circuit.
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
- Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode
- Check the function and actuation of the various valves and pressure/temperature senders installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If no fault can be found, extract the refrigerant from the refrigerant circuit.
- The quantity of refrigerant extracted is significantly greater than the prescribed charge quantity:
- Recharge the refrigerant circuit and repeat the test.
- The quantity of refrigerant extracted is about equal to the prescribed charge quantity:
- Check the actuation and function of the air conditioner compressor and the valves installed in the refrigerant circuit (shut-off valves and expansion valves) ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- Depending on the result, repair the actuation or renew the defective component (shut-off valve, expansion valve or air conditioner compressor as well as receiver/dryer) ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If no fault can be found there may be too much refrigerant oil in the circuit. Clean the refrigerant circuit (flush with R1234yf refrigerant ⇒ ["1.6 Cleaning refrigerant circuit", page 91](#) ).

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)



## Note

- ◆ *The cause of this fault could also be too much refrigerant oil in the circuit. Overfilling with refrigerant oil can occur if the refrigerant oil level was not checked after the air conditioner compressor was renewed.*
- ◆ *Further notes regarding this ➔ [page 235](#).*

### Possible deviation from specification during pressure test

- High pressure and low pressure normal
  - The requisite cooling output in the evaporator of the heating and air conditioning unit and in the evaporator for cooling the high-voltage components is not reached.
- or
- High pressure and low pressure normal
  - The air conditioner compressor is noisy (especially immediately after being switched on)
  - The requisite cooling output in the evaporator of the heating and air conditioning unit (and/or in the evaporator used to cool the high-voltage components) is not reached.

### Possible causes for deviation from specification and rectification

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode and ➔ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ Actuation and function of air conditioner compressor faulty ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- ◆ Too much refrigerant in circuit.
- ◆ Expansion valve for the evaporator in the front heating and air conditioning unit defective.
- ◆ Too much refrigerant oil in circuit.
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode and ➔ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
- Check the actuation and function of the air conditioner compressor and repair ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode
- Check the function and actuation of the various valves and pressure/temperature senders installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ➔ Vehicle diagnostic tester in "Guided Fault Finding" mode and ➔ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- If no fault can be found, extract the refrigerant from the refrigerant circuit.
- The quantity of refrigerant extracted is significantly greater than the prescribed charge quantity:
- Recharge the refrigerant circuit and repeat the test.
- The quantity of refrigerant extracted is about equal to the prescribed charge quantity:
- Clean the refrigerant circuit (flush with R1234yf refrigerant ➔ ["1.6 Cleaning refrigerant circuit", page 91](#) ).
- Pour in the correct amount of refrigerant oil in the circuit (see note).

### Final measures



#### Possible deviation from specification during pressure test

- Recharge the refrigerant circuit ⇒ [“2.6 Charging refrigerant circuit”, page 140](#)
- Repeat test  
⇒ [“2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor”, page 199](#)



#### Note

- ◆ *Overfilling with refrigerant oil can occur if the refrigerant oil level was not checked after the air conditioner compressor was renewed.*
- ◆ *If e.g. the expansion valve for the evaporator in the heating and air conditioning unit or for the evaporator used to cool the high-voltage components is defective (always open), the evaporator temperature (in the front heating and air conditioning unit) is no longer regulated in such a way that only gaseous refrigerant exits the evaporator. It is then possible that under certain operating conditions, drops of liquid will be drawn into the air conditioner compressor, which will then cause noise (because liquid is incompressible).*
- ◆ *If there is too much refrigerant in the refrigerant circuit, the air conditioner compressor must be emptied and the receiver renewed. After cleaning the refrigerant circuit (flushing with R1234yf refrigerant)  
⇒ [“1.6 Cleaning refrigerant circuit”, page 91](#) , pour the correct amount of refrigerant oil in the circuit ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual).*
- ◆ *Further notes regarding this ⇒ [page 235](#) .*

#### Possible deviation from specification during pressure test

- High pressure and low pressure normal
- The requisite cooling output in the evaporator of the front heating and air conditioning unit (and in the evaporator for cooling the high-voltage components) is not reached.
- The requisite cooling output is not reached in the heat exchanger for heat pump operation.

#### Possible causes for deviation from specification and rectification



### Possible deviation from specification during pressure test

- ◆ One of the pressure/temperature senders or temperature sensors on or in the refrigerant circuit supplies incorrect values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system
- ◆ One of the pumps or one of the valves in the coolant circuit of the high-voltage battery or the engine is defective or does not work properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit (vehicle-specific workshop manual).
- ◆ Actuation and function of air conditioner compressor faulty ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode.
- ◆ One of the valves installed in the refrigerant circuit is defective or is not working properly ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check the measured values of the various pressure/temperature senders and temperature sensors during operation of the air conditioning system, renew components with false measured values ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Overview of fitting locations - air conditioning system .
- Check how the heat exchanger is included in the coolant circuit of the engine and also check the function and actuation of the various pumps and valves ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit (vehicle-specific workshop manual).
- Check the actuation and function of the air conditioner compressor and repair ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode
- Check the function and actuation of the various valves and pressure/temperature senders installed in the refrigerant circuit by means of the pressure distribution in the refrigerant circuit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual).
- Check the function and actuation of the components used to cool the high-voltage components ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode - air conditioning system, air conditioner compressor and battery regulation
- If no fault can be found, extract the refrigerant from the refrigerant circuit.
- Extract refrigerant from the refrigerant circuit ⇒ ["2.4 Emptying refrigerant circuit", page 131](#) .
- If the extracted refrigerant volume is considerably less than the specified fill volume (more than 100 g less) ⇒ Heating, air conditioning; Rep. gr. 00 ; Technical data (vehicle-specific workshop manual), search for the leak and rectify the cause ⇒ ["1.4 Investigating leaks", page 67](#)
- The extracted refrigerant volume approximately equates to the prescribed fill volume, check actuation of the air conditioner compressor and the installed shut-off valves if no fault is found ⇒ Heating, air conditioning; Rep. gr. 87 ; Refrigerant circuit (vehicle-specific workshop manual)
- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)

### Final measures

- Recharge the refrigerant circuit ⇒ ["2.6 Charging refrigerant circuit", page 140](#)
- Repeat test  
⇒ ["2.14.5 Checking pressures with air conditioning system switched on - vehicles with electrical air conditioning compressor", page 199](#)





## Note

- ◆ *If the requisite cooling output at the evaporator in the front heating and air conditioning unit (and at the evaporator used to cool the high-voltage components) is OK and there is a problem owing to lack of heating output in the heat exchanger for heat pump operation. The cause could be in the coolant circuit of the high-voltage system or in the coolant circuit of the engine. If the pumps and valves in the coolant circuit of the high-voltage system are not actuated correctly or their function is not OK, not enough heat energy can be drawn from the coolant via the evaporator (heat exchanger) used to cool the high-voltage components. If the pumps and valves in the coolant circuit of the engine are not actuated correctly or their function is not OK, the heat energy cannot be dissipated via the heat exchanger for heat pump function to the coolant that flows to the heat exchanger in the heating and air conditioning unit ⇒ Vehicle diagnostic tester in "Guided Fault Finding" mode and ⇒ Heating, air conditioning; Rep. gr. 87 ; Coolant circuit (vehicle-specific workshop manual).*
- ◆ Further notes regarding this ⇒ [page 235](#) .





### 3 Testing equipment and tools

⇒ [“3.1 Tools and materials available from distribution centre or importer”, page 252](#)

⇒ [“3.2 Tools and materials available commercially”, page 252](#)

⇒ [“3.3 Tools that can be locally manufactured”, page 253](#)

#### 3.1 Tools and materials available from distribution centre or importer

Tools and materials are available from the “Electronic parts catalogue (ETKA)” ⇒ Electronic parts catalogue .

Overview
Air conditioner service station with flushing device
– With integrated program for flushing the refrigerant circuit with R1234yf refrigerant and the associated flushing device
– With integrated analysis unit for finding contamination in the R1234yf refrigerant
R1234yf refrigerant ⇒ Electronic parts catalogue
Extraction device (for R1234yf refrigerant) dry ice box
Adapter case, VW/Audi passenger vehicle set
– Used to connect the air conditioner service station to the refrigerant circuit for flushing and for bridging removed components when flushing
– Used to connect certain components to the pressure hose to blow through with compressed air or nitrogen
Leak detector for R1234yf/R134A
Combination fine filter unit for compressed air system
Seals (different versions, pay attention to correct allocation) ⇒ Electronic parts catalogue
Refrigerant oil (different versions, pay attention to correct allocation) ⇒ Electronic parts catalogue
Leak detection system with following contents:
◆ Cleaning agent
◆ UV leak detector lamp
◆ Replacement bulb for leak detector lamp
◆ Safety glasses
◆ Sticker
◆ Protective gloves
◆ System case
Tracer replenishment cartridge
Release tools for refrigerant line with quick-release couplings
Removal tool for quick-release couplings of refrigerant lines
Tool attachments for removing and installing valves

#### 3.2 Tools and materials available commercially



##### Note

*This list is an overview of the test equipment, tools and materials necessary for professional repairs to the refrigerant circuit.*



Overview
Fin comb
Charge hoses 5/8"-18 UNF
Connector piece for pressure cylinders for refrigerant and sealing ring with quick-release connector or threaded connector
Valve cap 5/8" -18 UNF
Pressure gauge set with pressure reducer for nitrogen
Quick release coupling adapter for service connections (qty. 2 included with air conditioner service station ).
Flared ring spanners of widths matching those of the threaded connections on the refrigerant lines.
Valve opener for charge hoses
Connection nipple for conical surface seal 5/8"-18 UNF
Compressed air gun with rubber tip
Manual stop valve 5/8" -18 UNF
Recycling cylinder for contaminated R1234yf refrigerant
Digital thermometer
Protective gloves
Safety glasses
Dry ice pellets

### 3.3 Tools that can be locally manufactured



#### Note

*This list is an overview of the test equipment, tools and materials necessary for professional repairs to the refrigerant circuit.*

Overview	Page
Charging hose with connection to workshop compressed air system	Not illustrated

#### Charging hose with connection to workshop compressed air system

A - Charging hose 5/8" - 18 UNF\*\* (version with large internal diameter)

B - Connector for workshop compressed air system\*\* (for use only with filter)

\*\* Tools and materials available commercially

